

AD-A133 055

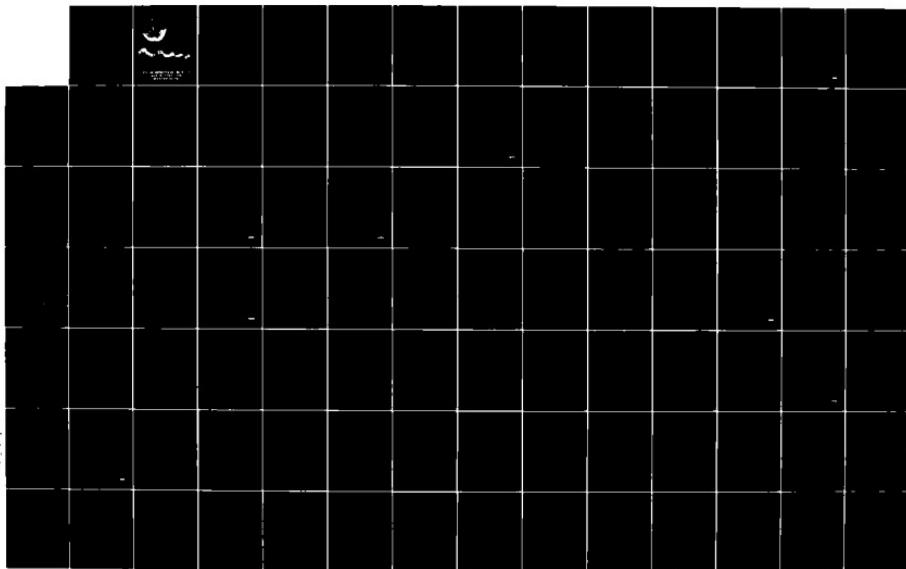
CAVE BUTTES DAM MASTER PLAN PHOENIX ARIZONA AND  
VICINITY (INCLUDING NEW RIVER)(U) ARMY ENGINEER  
DISTRICT LOS ANGELES CALIF MAR 82

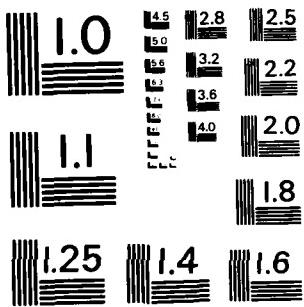
1/2

UNCLASSIFIED

F/G 13/2

NL



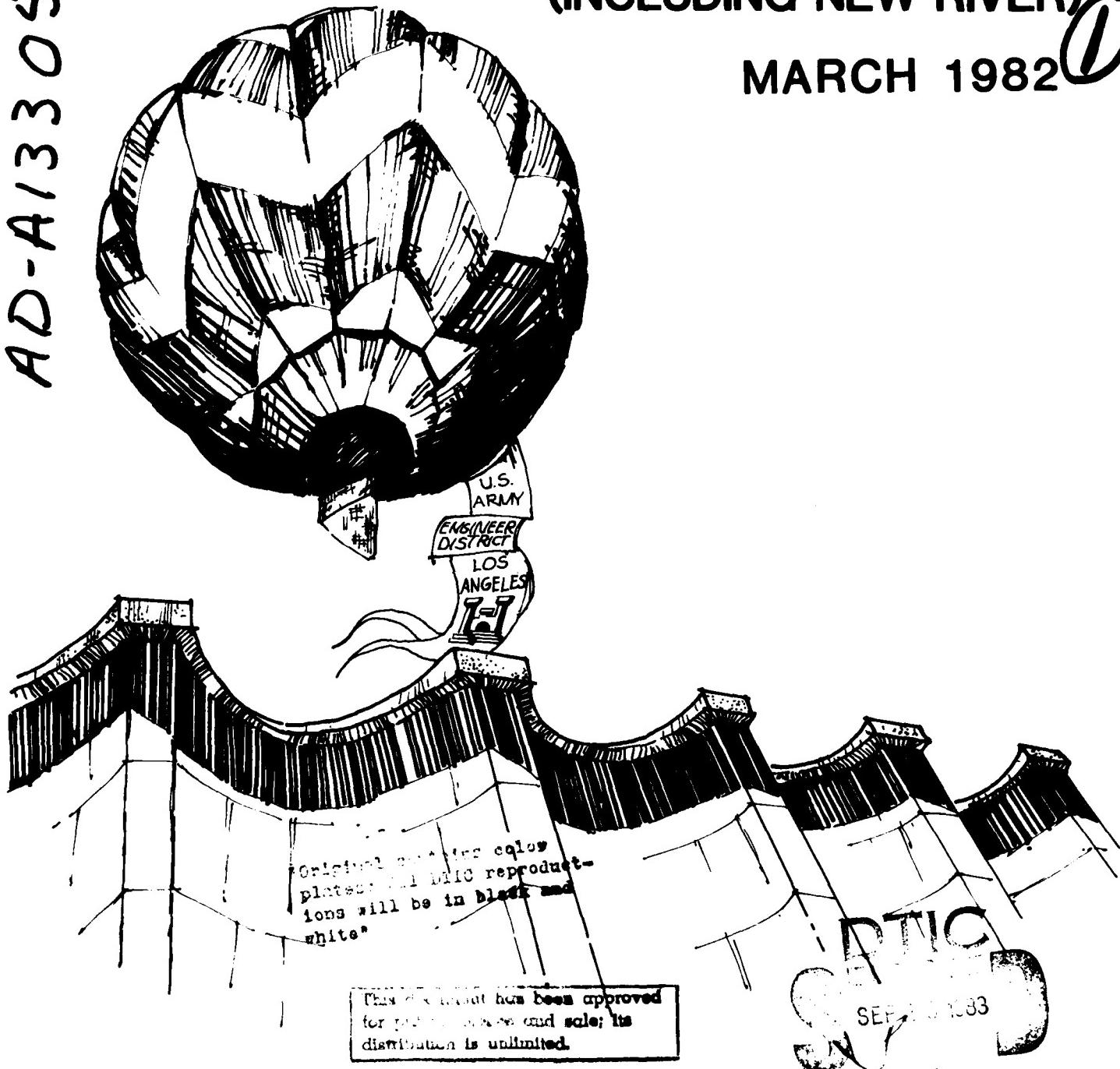


MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS - 1963 - A

AD-A133055

PHOENIX, ARIZONA & VICINITY  
(INCLUDING NEW RIVER)

MARCH 1982



**DESIGN MEMORANDUM NO. 6**  
**CAVE BUTTES DAM**  
DTIC FILE COPY **MASTER PLAN**

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER  Memorandum No. 6	2. GOVT ACCESSION NO.  AD-A133055	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle)  Cave Buttes Dam Master Plan	5. TYPE OF REPORT & PERIOD COVERED	
	6. PERFORMING ORG. REPORT NUMBER  N/A	
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)  N/A	
9. PERFORMING ORGANIZATION NAME AND ADDRESS  U.S. Army Corps of Engineers Los Angeles District P.O. Box 2711 Los Angeles, CA 90053	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS  N/A	
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE  March 1982	
	13. NUMBER OF PAGES  N/A	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report)  Unclassified	
N/A	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE  N/A	
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)  <i>Abstracts ions will be white.</i>		
18. SUPPLEMENTARY NOTES  Copies are obtainable from the National Technical Information Service, Springfield, VA 22151		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  Recreation Planning		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  Cave Buttes provides flood protection to the Metropolitan Phoenix area. This document provides a factual, environmental sound basis for the development, use, and management of both natural and man-made resources, within Cave Buttes Dam basin. The document also presents a specific land use site plan with estimated costs for such a plan.		

Phoenix, Arizona and Vicinity

(Including New River)

CAVE BUTTES DAM MASTER PLAN

Design Memorandum No. 6

Accession For	
NTIS GRA&I	X
DTIC TAB	
Unannounced	
Justification	
By _____	
Distribution/	
Availability Codes	
Avail and/or	
DIST	Special



"Original plates will be black and white."

U.S. ARMY CORPS OF ENGINEERS

LOS ANGELES DISTRICT

MARCH 1982

REPORTS PREVIOUSLY ISSUED

<u>No.</u>	<u>Title</u>	<u>Date</u>	<u>Date Approved</u>
	Interim Report on Survey for Flood Control--Phoenix, Arizona and Vicinity (Incl. New River)	Jan. 1964	May 1965
1	Feature Design for Dreamy Draw Dam, Gila River Basin, New River and Phoenix City Streams, Arizona	Jan. 1971	May 1972
	Final Environmental Impact Statement, Dreamy Draw Dam, Maricopa County, Arizona	Mar. 1972	May 1972 (filed with CEQ)
2	New River and Phoenix City Streams, Arizona, Hydrology, Part 1	Oct. 1974	Mar. 1975
3	New River and Phoenix City Streams, Arizona, Design Memorandum No. 3, General Design Memorandum--Phase I, Plan Formulation	Mar. 1976	July 1977 (SPD App)
	Final Environmental Impact Statement, New River and Phoenix City Streams, Maricopa County, Arizona	Mar. 1976	Sept. 1976 (filed with CEQ)
3	New River and Phoenix City Streams, Arizona, Design Memorandum No. 3, General Design Memorandum--Phase II, Project Design		
	Part I--Cave Buttes Dam (including Cave Creek to Peoria Avenue)	July 1976	July 1977
	Part II--Adobe Dam (including Skunk Creek to the Arizona Canal)	Apr. 1979	Dec. 1979
4	New River and Phoenix City Streams, Arizona, Design Memorandum No. 4, Overall Master Plan	Sept. 1980	March 1982 (SPD App)
5	New River and Phoenix City Streams, Arizona, Design Memorandum No. 5, Master Plan and Feature Design Memorandum, Dreamy Draw Dam	Sept. 1981	Jan. 1982 (SPD App)

REPORTS SCHEDULED FOR FUTURE ISSUANCE

<u>No.</u>	<u>Title</u>	<u>Scheduled Date</u>
2	Phoenix, Arizona and Vicinity, (Including New River), Hydrology Part 2	June 1982
3	New River and Phoenix City Streams, Arizona, Design Memorandum No. 3, General Design Memorandum--Phase II, Project Design	
	Part 3--New River Dam (including New River to Skunk Creek)	May 1982
	Part 4--Skunk Creek and New and Agua Fria Rivers below the Arizona Canal Diversion Channel	July 1984
	Part 5--Arizona Canal Diversion Channel (including Cave Creek Channel)	May 1984
6	Phoenix, Arizona and Vicinity (including New River), Design Memorandum No. 6, Master Plan - Cave Buttes Dam	March 1982
7	Phoenix, Arizona and Vicinity (including New River), Design Memorandum No. 7, Master Plan - Adobe Dam	Apr. 1983
6A	Phoenix, Arizona and Vicinity (including New River), Design Memorandum No. 6A, Feature Design, Phase I Development - Cave Buttes Dam	Sept. 1983
7A	Phoenix, Arizona and Vicinity (including New River), Design Memorandum No. 7A, Feature Design, Phase I Development - Adobe Dam	May 1984
8	Phoenix, Arizona and Vicinity (including New River), Design Memorandum No. 8, Feature Design - Cultural Resources Interpretive Center	June 1984

REPORTS SCHEDULED FOR FUTURE ISSUANCE

<u>No.</u>	<u>Title</u>	<u>Scheduled Date</u>
7B	Phoenix, Arizona and Vicinity (including New River), Design Memorandum No. 7B, Feature Design, Phase II Development - Adobe Dam	*
6B	Phoenix, Arizona and Vicinity (including New River), Design Memorandum No. 6B, Feature Design, Phase II Development - Cave Buttes Dam	*
9	Phoenix, Arizona and Vicinity (including New River), Design Memorandum No. 9, Feature Design New River Dam	*

\* Not determined

## CONTENTS

	Page
<b>REPORTS PREVIOUSLY ISSUED.....</b>	<b>iii</b>
<b>REPORTS SCHEDULED FOR FUTURE ISSUANCE.....</b>	<b>iv</b>
<b>1. INTRODUCTION.....</b>	<b>1</b>
A. Project Authorization.....	1
B. Project Purpose.....	1
C. Purpose of Master Plan.....	2
D. Scope of Master Plan.....	2
E. Prior Pertinent Reports.....	4
F. Applicability of Selected Public Laws.....	7
G. Environmental Impact Statement.....	8
<b>2. PROJECT DESCRIPTION.....</b>	<b>9</b>
A. Project Location.....	9
B. Project Features.....	9
C. Esthetic Treatment.....	14
D. Reservoir Operation.....	16
E. Plans for Protection of Archeological Resources.....	17
<b>3. CONSTRUCTION PROJECT STATUS.....</b>	<b>18</b>
<b>4. ENVIRONMENTAL RESOURCES.....</b>	<b>19</b>
A. General.....	19
B. Climatology.....	19
C. Physiography.....	19
D. Geology.....	20
E. Hydrology.....	20
F. Ground Water.....	21
G. Biological Resources.....	21
H. History.....	26
I. Roads Within Project Area.....	26
J. Existing Land Use.....	28
K. Visual Quality.....	28
<b>5. SOCIAL AND ECONOMIC FACTORS.....</b>	<b>30</b>
A. General .....	30
B. Area of Influence.....	30
C. Demographic Characteristics.....	31
D. Accessibility.....	33
E. Sociological Perspective.....	33
F. Visitation.....	34

CONTENTS (Continued)

	Page
<b>6. FACTORS INFLUENCING AND CONSTRAINING RESOURCE DEVELOPMENT AND MANAGEMENT.....</b>	<b>36</b>
A. General.....	36
B. Climatology.....	36
C. Physiography.....	36
D. Geology.....	37
E. Seismicity.....	37
F. Soils Limitations.....	37
G. Archeological Sites.....	41
H. Local Recreation Areas.....	45
I. Application of Public Law 89-72 and Other Legislative or Administrative Requirements for Cost Sharing.....	49
<b>7. COORDINATION WITH OTHER AGENCIES.....</b>	<b>50</b>
<b>8. PHYSICAL PLAN OF DEVELOPMENT.....</b>	<b>52</b>
A. General.....	52
B. Land Use Plan.....	52
C. Recreation.....	53
D. Phase I Recreation Development.....	55
E. Phase I Wildlife Enhancement.....	62
F. Phase II Recreation Development.....	63
G. Phase II Wildlife Enhancement.....	68
H. Cave Creek Regional Park.....	69
I. Schedule of Development.....	75
J. Cost Estimates.....	76
K. Discussion of Cost Increases.....	77
<b>9. FACILITY LOAD AND OTHER DESIGN CRITERIA.....</b>	<b>85</b>
A. General.....	85
B. Siting.....	85
C. Water Supply System.....	86
D. Waste Treatment System.....	86
E. Roads.....	87
F. Circulation.....	88
G. Architectural Character.....	89
H. Parking Areas.....	90
I. Lake Development.....	90
J. Picnic Areas.....	91
K. Camping Areas.....	91
L. Overlook Structure.....	92
M. Restrooms.....	93
N. Utilities.....	93
O. Hiking and Equestrian Trails.....	93
P. Landscape Planting Criteria.....	94
Q. Information Signs.....	95
R. Multiuse Turfed Areas and Multiuse Paved Areas.....	96

CONTENTS (Continued)

	Page
10. SPECIAL PROBLEMS.....	97
A. Mine Shafts and Tunnels.....	97
B. Lake Water Source.....	97
C. Balloon Launch.....	98
D. Trail Continuity.....	98
E. Lagoon Water Source.....	99
F. Trails through Proposed Retriever Training Area and Combined Training Area.....	100
G. Radio-Controlled Model Airplanes.....	100
H. Lease Borrow Sites.....	101
I. Special Meets and Competitions.....	101
11. CONCLUSIONS.....	103
12. RECOMMENDATIONS.....	105

**APPENDIX**

1. First Letter of Intent.....	A-1
2. Letter of Intent Authorization.....	A-2
3. Letter of Intent for Latest Plans.....	A-3

Tables

1. Pertinent Physical Data.....	13
2. Comparison of Estimated Annual Project Supply with Existing Unmet Demand - Cave Buttes Dam.....	35
2A. Comparison of Estimated Annual Project Supply with Existing Unmet Demand - Cave Creek from Peoria Ave to the ACDC.....	35A
3. Soils Limitations for Recreation Development.....	39
4. Inventory of Regional Parks in Maricopa County.....	46
5. Recreation Facilities Proposed for Development by Maricopa County and the City of Phoenix.....	48
6. Cost Estimate-Phase I.....	79
7. Cost Estimate-Phase II.....	80
8. Cost Estimate-Cave Creek Regional Park from Peoria Avenue to the ACDC.....	81
9. Costs Summary-Cave Buttes Dam Recreation Area.....	82
10. Costs Summary-Cave Creek Regional Park.....	84

Figures

1. Extent of Watershed.....	10
2. Location of Mine Shafts.....	27
3. Location of the Cave Creek Archeological District in Central Arizona.....	44

Plates

1. Recommended Plan for Recreation
2. Recreation Resources of Maricopa County
3. Recommended Plan for Flood Control
4. Flood Zones
5. Climatologic Summary
6. Cross Section of Ecosystem
7. Vegetation
8. Existing Land Use
9. Site Analysis
10. Recreation Market Area
11. Future Land Use
12. Land Ownership
13. Slope Analysis
14. Site Plan, Phase I
15. Overlook and Sundial
16. View From Overlook
17. Site Plan, Phase II
- 18A. Cave Creek Regional Park
- 18B. Cave Creek Regional Park
- 18C. Cave Creek Regional Park
- 18D. Cave Creek Regional Park
19. Phase II Aerial View

# **Introduction**

## Chapter 1

### INTRODUCTION

#### A. PROJECT AUTHORIZATION.

The Phoenix, Arizona and Vicinity (including New River) flood control project (also known as New River and Phoenix City Streams) was specifically authorized by the 1965 Flood Control Act (Public Law 89-298), which was approved 27 October 1965. Recreation development is also possible under Section 4 of the Flood Control Act of 1944, as amended by Section 207 of the Flood Control Act of 1962.

#### B. PROJECT PURPOSE.

Flood hazards have always been an important consideration for the planners of a desert community, especially as they affect the city's growth and expansion into new areas. But the provision of recreation opportunities for community residents has become a major concern only in the past few decades. Rapid increases in the income, leisure time, and size of the postwar Phoenix population - combined with a climate that permits year-round enjoyment of recreation activities - have produced a large unsatisfied demand for recreation facilities of all kinds. By developing needed recreation facilities at the Cave Buttes Dam site which are compatible with its primary purpose, provision of flood control, the Corps of Engineers and Maricopa County will respond to the pressing recreation needs of the Phoenix metropolitan area. Because flood water will be discharged from the dam into Cave Creek, flood plain management between the damsite and the Arizona Canal is required; this provides an additional opportunity for project-related development of recreation features along a portion of the creek (pl. 1).

### C. PURPOSE OF MASTER PLAN

The primary purposes of the master plan are: (1) to provide a basis for understanding the factors influencing and constraining recreation development at Cave Buttes Dam, and (2) to describe the proposed physical plan for development of the site.

### D. SCOPE OF MASTER PLAN

The master plan provides a general overview of flood control features, recreation features, land use plans, time schedules, cost estimates, project management, and factors (environmental, social, and economic) affecting recreation development within the project area.

The special needs and characteristics of the project lands have been identified and matched to the perceived needs of the community. Studies conducted by various agencies substantiate the need for additional outdoor recreation facilities throughout Maricopa County (pl. 2). Many of the existing public outdoor recreation facilities within the Phoenix area are overcrowded with weekend users, particularly during peak months. The projected population growth for the City of Phoenix, as well as for Maricopa County, will intensify the existing crowded situation. Therefore, there is a need to identify the maximum carrying capacity of the project lands. By setting limits to use, the environment will be preserved. Another important aspect of master planning is identifying safety hazards and assigning priorities to certain land uses, such as:

- o Preservation of wildlife species and their habitat
- o Operation and maintenance of the dam and reservoir

- Wise use of project environmental resources
- Preservation of open space for recreation uses
- Continued use of extractive resources such as gravel
- Continued use of renewable resources such as grazing

Cave Creek Regional Park is proposed for development within the Cave Creek floodway. The floodway is a nonstructural element of the New River and Phoenix City Streams flood control project. Presently, there is no clear guideline for Corps participation in recreation for nonstructural elements.

At present, the Corps can cost share within the channel portion of Cave Creek between Peoria Avenue and the Arizona Canal Diversion Channel. Should the policies be developed that allow Federal cost sharing of recreation development in nonstructural flood control projects, a plan will be readily available for a local sponsor to participate in the construction of project-oriented recreation features along Cave Creek from Cave Buttes Dam to Peoria Avenue.

Through the implementation of this master plan, the park's eventual development by the Corps and/or other agencies will be consistent with accepted planning principles and will be compatible with the project flood control requirements, such as maintenance of the floodway. In addition, any future development planned by others can be designed to augment or complement the recreation facilities proposed for the Cave Buttes Dam basin and Cave Creek Regional Park. The City of Phoenix is in the process of revising the recreation development plans for the Cave Creek floodway which are described on pages 69-75 following.

#### E. PRIOR PERTINENT REPORTS

A list of previously issued design memoranda appears in the front matter of this master plan. The reports most applicable to development in the Cave Buttes Dam basin and along Cave Creek Wash are the following:

Final Environmental Impact Statement New River and Phoenix City Streams, Arizona	March 1976
New River and Phoenix City Streams, Arizona, Design Memorandum No. 3 - General Design Memorandum - Phase I, Plan Formulation	March 1976
New River and Phoenix City Streams, Arizona, Phase II Design Memorandum - Project Design, Part 1 - Cave Buttes Dam	July 1976
New River and Phoenix City Streams, Arizona Design Memorandum No. 4 - Overall Master Plan	Sept. 1980
Environmental Assessment for Cave Buttes Dam Master Plan	April 1982

Additional pertinent publications used as guides in the preparation of the Master Plan for the Cave Buttes basin and along Cave Creek Wash are the following:

Cave Creek Park, a Development Concept for the City of Phoenix, Van Cleeve Associates, Inc., Consulting Planners, Scottsdale, Arizona	Aug. 1968
The Park and Recreation Plan, Summary, Phoenix, Arizona, Parks and Recreation Board and Planning Commission, City of Phoenix	July 1970
Recreation Planning, Development and Management Policies (ER 1165-2-400), Office of the Chief of Engineers, Department of the Army	Aug. 1970
Federal Participation in Recreational Development (EC 1120-2-404), Office of the Chief of Engineers, Department of the Army	Aug. 1970
A Park, Recreation, and Open Space Study, Maricopa County Planning and Zoning Department, Maricopa Association of Governments	Sept. 1970

Arizona Statewide Comprehensive Outdoor Recreation Plan, Arizona Outdoor Recreation Coordinating Commission	1970
Environmental Quality in Design of Civil Works Projects (EM 1110-2-38), Office of the Chief of Engineers, Department of the Army	May 1971
Recreation Planning and Design Criteria (EM 1110-2-400), Office of the Chief of Engineers, Department of the Army	Sept. 1971
Recreation Resources Planning (ER 1120-2-400), Office of the Chief of Engineers, Department of the Army	Nov. 1971
Lynch, Kevin, "Site Planning", Cambridge, Mass. M.I.T. Press.	1971
Design of Recreation Sites, Areas, and Facilities (ER 1110-2-400), Office of the Chief of Engineers, Department of the Army	Sept. 1974
Principles Governing Financial Participation by the Corps of Engineers in Recreation Development of Local Flood Control Projects, Office of the Chief of Engineers, Department of the Army	June 1976
Design for the Physically Handicapped (EM 1110-1-103 and ER 1110-1-102), Office of the Chief of Engineers, Department of the Army	Oct. 1976
Soil Survey of Maricopa County, Arizona, Central Part, Department of Agriculture, Soil Conservation Service	Sept. 1977
Arizona Statewide Comprehensive Outdoor Recreation Plan, Arizona Outdoor Recreation Coordinating Commission	Jan. 1978
Resource Use: Establishment of Objectives (ER 1105-2-167), Office of the Chief of Engineers, Department of the Army	Apr. 1978
Design for the Physically Handicapped (ETL 1110-1-95), Office of the Chief of Engineers, Department of the Army	May 1978
Arizona Statistical Review, Valley National Bank of Arizona	Sept. 1978

Inside Phoenix '78, Phoenix Newspaper, Inc. 1978

Henderson, T.K., and Rodgers, J.B., Archaeological  
investigations in the Cave Creek area, Maricopa  
County, South-Central Arizona, Arizona State  
University Anthropological Research Papers No. 17,  
Technical Paper No. 2. 1979

#### F. APPLICABILITY OF SELECTED PUBLIC LAWS

The following laws provide guidance for the development and management of Federal projects for various purposes, according to the intent of Congress and as they apply to the New River and Phoenix City Streams Project:

1. Section 4, Public Law 78-534 (The Flood Control Act of 1944), as amended, authorizes the Corps of Engineers to construct, maintain, and operate public park and recreation facilities at water resource development projects and to permit local interests to construct, maintain, and operate such facilities.
2. Public Law 85-624 (The Fish and Wildlife Coordination Act of 1958), provides for the integration of fish and wildlife conservation in water resources projects. The U.S. Fish and Wildlife Service has prepared a report, dated 1 February 1978, pertaining to the fish and wildlife resources of the project area. The recommendations and findings contained in the report have been given full consideration. Coordination with related state and Federal agencies was maintained during the development of this master plan.
3. Public Law 89-72 (The Federal Water Project Recreation Act of 1965), accompanied by House Committee Report 254, requires that full consideration be given to opportunities the project affords for outdoor recreation and for fish and wildlife enhancement. It also provides for non-Federal participation in land acquisition and in the development and management of recreation facilities and fish and wildlife resources.

4. Section 204, Public Law 89-298 (The Flood Control Act of 1965), authorizes the Corps of Engineers to construct the New River and Phoenix City Streams Flood Control Project for flood protection in Phoenix, Arizona, and vicinity (pl. 3).

5. Public Law 91-190 (The National Environmental Policy Act of 1969), requires that the environmental effects of each project and the means and measures to minimize any adverse effects be evaluated and presented in an environmental impact statement (EIS).

6. Executive Order 11988 (Flood Plain Management, February 1978) prescribes the extent of Federal development permitted on flood prone lands. It also requires that Federal agencies consider the unique and significant values of flood plains and promote these values for the maximum public benefit.

#### G. ENVIRONMENTAL IMPACT STATEMENT (EIS)

The EIS for the New River and Phoenix City Streams project addresses recreation development at the Cave Buttes Dam basin. Presently, the basin area is used by hunters, hikers, and off-road vehicle operators; most of this activity involves trespassing. The EIS for the basin area states that development of recreation facilities will eliminate some of the informal recreation activities presently taking place at the damsite. An environmental assessment has been prepared which addresses the changes made to the recreation plans subsequent to the completion of the EIS.

# **Project Description**

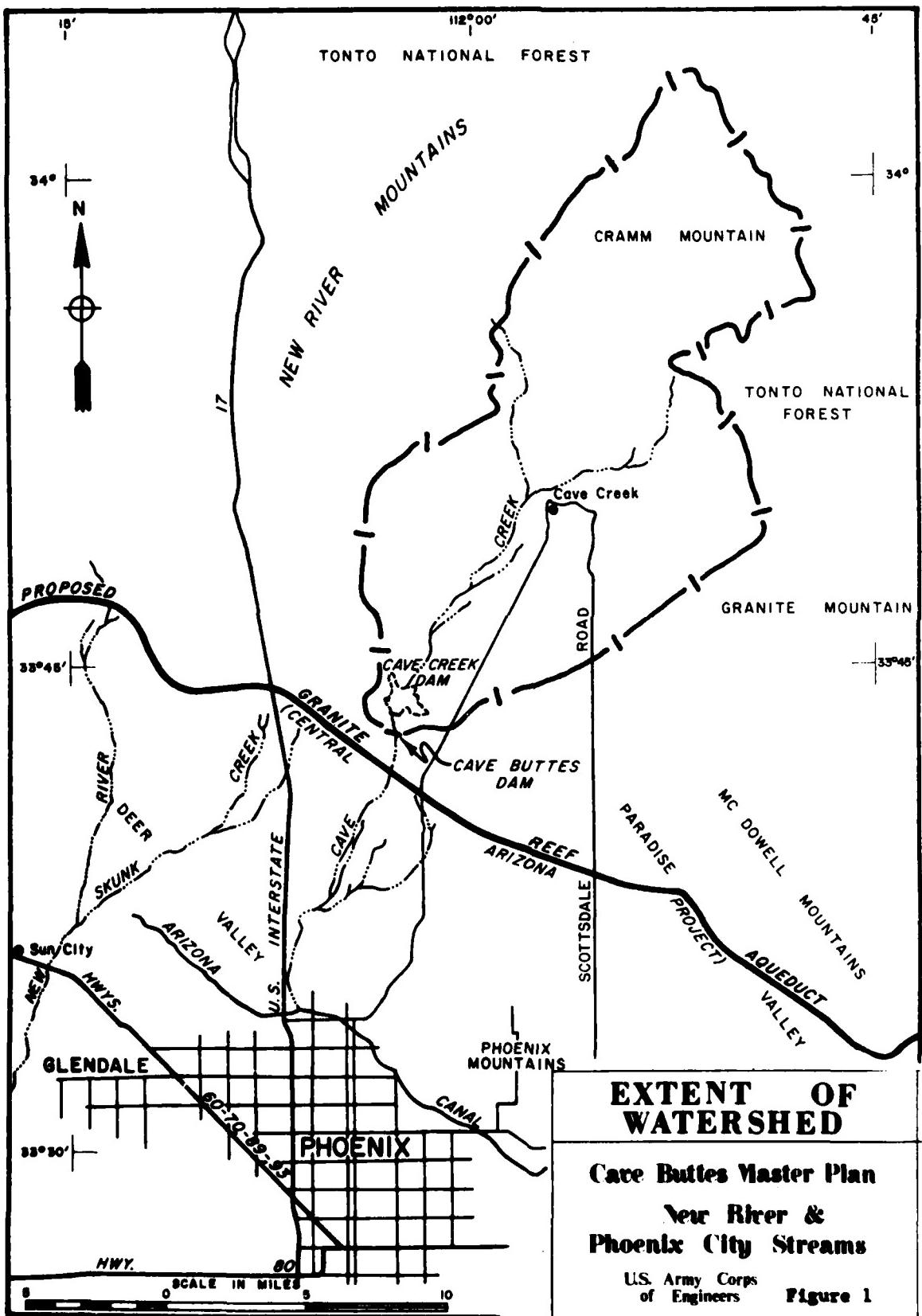
Chapter 2  
PROJECT DESCRIPTION

A. PROJECT LOCATION

Cave Buttes Dam is on Cave Creek, 0.7 mile (1.1 km) south (downstream) of the existing Cave Creek Dam and about 18 miles (30 km) north of the Phoenix Civic Center. Flows discharging from the outlet conduit of Cave Buttes Dam will proceed about 10 miles (16 km) down Cave Creek to the Arizona Canal in the City of Phoenix. The nonstructural portion of the project along Cave Creek (may not be cost shareable) is a natural channel from Cave Buttes Dam to Peoria Avenue. The structural portion of the project along Cave Creek (cost shareable) will be an improved channel from Peoria Avenue to the Arizona Canal. This reach has yet to be designed.

B. PROJECT FEATURES

Cave Buttes Dam controls a drainage area of  $191 \text{ mi}^2$  ( $495 \text{ km}^2$ ), as shown in Figure 1. The dam impounds floodwater and provides storage for a 100-year accumulation of sediment. The dam is designed to regulate the standard project flood, with provision of a spillway for routing the maximum probable flood through the reservoir. At spillway crest elevation 1657.1 ft (505.1 m), the gross capacity of the reservoir is 46,600 acre-ft (5730 ha-m); 40,900 acre-ft (5030 ha-m) are allocated for flood control and 5700 acre-ft (700 ha-m) for sedimentation. The reservoir design flood will be regulated from a peak inflow of 54,000 cubic feet per second ( $1530 \text{ m}^3/\text{s}$ ) to a maximum outflow of 486  $\text{ft}^3/\text{s}$  ( $13.8 \text{ m}^3/\text{s}$ ).



The maximum spillway release will be 100,600 ft<sup>3</sup>/s (2850 m<sup>3</sup>/s) with a probable maximum flood peak inflow of 172,000 ft<sup>3</sup>/s (4870 m<sup>3</sup>/s).

Plate 4 indicates areas expected to be inundated during floods of 25-, 50- and 100-year frequencies, plus the standard project flood. Flood outlines are based on Cave Buttes Dam's elevation frequency curve and assume a 100-year accumulation of sediment in the basin.

Important features of the dam include the main embankment, three dikes, outlet works, an unlined spillway, and a drainage channel. Pertinent information on these features is given in the following paragraphs.

#### 1. Dam and dikes.

The main embankment, constructed on Cave Creek, is 2275 ft (693.4 m) in length and 109 ft (33.2 m) in height above the existing streambed. Dike No. 1 is approximately 300 ft (90 m) east of the main embankment. This dike is 935 ft (285 m) in length and 39 ft (12 m) in maximum height. Dike No. 2, approximately 6000 ft (1830 m) northeast of the main embankment, is 9005 ft (2745 m) in length and 55 ft (17 m) in maximum height. The easternmost 3580 ft (1091 m) of Dike No. 2 is designed to divert floodwater from the drainage area northeast of Cave Creek Road. This portion of the dike has a variable height, ranging from 6 to 10 ft (1.8 to 3.0 m) above the existing ground level. Dike No. 3, approximately 2.5 mi (4 km) northwest of the main embankment, is 3245 ft (989.1 m) in length and 10 ft (3.4 m) in maximum height above the existing ground level.

2. Outlet works.

The outlet works consist of an approach channel, an ungated intake structure, a conduit 548.5 ft (167.2 m) long, and a stilling basin. The outlet conduit is 3.75 ft (1.1 m) in diameter and is capable of discharging up to 494 ft<sup>3</sup>/s (14 m<sup>3</sup>/s) with the water surface at spillway crest.

3. Spillway.

The spillway is approximately 1600 ft (490 m) west of the main embankment. The spillway, which is excavated in rock, is unlined, except at the spillway crest where a concrete sill is provided. The spillway has a crest length of 510 ft (155 m) and a trapezoidal cross section with side slopes of 1 vertical on 1.5 horizontal.

4. Drainage channel.

The drainage channel of Dike No. 2 is near the dike's west abutment. This channel is designed to drain a possible dead pool of 230 acre-ft (29 ha-m), which is created by the construction of the dike. The channel is excavated across a saddle that was designated as a spillway location in studies of Cave Creek Dam. The unlined, trapezoidal channel is 2800 ft (850 m) in length, 12 ft (3.6 m) in base width, and has side slopes of 1 vertical on 2 horizontal.

Table 1 provides pertinent data on Cave Buttes Dam.

Table 1. Pertinent Physical Data

Item	U.S. Units		Metric Units	
Drainage area	191	mi <sup>2</sup>	495	km <sup>2</sup>
Dam (rolled earthfill)				
Crest elevation	1679.1	ft msl	511.8	m msl
Maximum height above streambed	109	ft	33.2	m
Crest length	2275	ft	693.4	m
Freeboard	5	ft	1.5	m
Spillway (detached)				
Crest elevation	1657.1	ft msl	505.1	m
Crest length	510	ft	155	m
Elevation of maximum water surface	1674.1	ft msl	510.3	m
Outlet works (ungated conduit)				
Diameter of conduit	3.75	ft	1.1	m
Length	548.5	ft	167.2	m
Intake elevation	1560.3	ft msl	475.6	m
Saddle dike No. 1				
Crest length	935	ft	285	m
Maximum height above existing ground	39	ft	12	m
Saddle dike No. 2				
Crest length	9005	ft	2745	m
Maximum height above existing ground	55	ft	17	m
Saddle dike No. 3				
Crest length	3245	ft	989.1	m
Maximum height above existing ground	10	ft	3.0	m
Reservoir area at spillway crest	1820	acre	736.6	ha
Capacity (gross) at spillway crest	46,600	acre-ft	5730	ha-m
Storage allocation below spillway crest				
Flood control (net)	40,900	acre-ft	5030	ha-m
Sedimentation	5700	acre-ft	700	ha-m
Standard project flood				
Total volume	42,200	acre-ft	5190	ha-m
Peak inflow	54,000	ft <sup>3</sup> /s	1530	m <sup>3</sup> /s
Peak outflow	486	ft <sup>3</sup> /s	13.8	m <sup>3</sup> /s
Drawdown time	48	day		

Probable maximum flood				
Total volume	122,000	acre-ft	15,000	ha-m
Peak inflow	172,000	ft <sup>3</sup> /s	4870	m <sup>3</sup> /s
Peak outflow	100,600	ft <sup>3</sup> /s	2850	m <sup>3</sup> /s
Drawdown time	61	hours		

#### C. ESTHETIC TREATMENT

Construction of the dam and dike embankments, spillway, drainage channel, and access roads has altered the visual quality and character of the site. The use of borrow material for construction of the embankments removed about 350 acres (142 ha) of native vegetation, thereby destroying wildlife habitat. The large scars left in these areas and the barren embankments themselves have had a tremendous visual impact on the desert landscape. The esthetic treatment program was designed to minimize the long-range effects of this alteration.

The intensive environmental protection and esthetic treatment program that was carried out during the preconstruction, construction, and postconstruction phases was designed to enhance the visual quality of the project features and to restore the area.

##### 1. Preconstruction Phase.

The preconstruction phase helped protect land resources through proper planning and design; in addition, the contractor and the people associated with the project were informed of the implications of environmental degradation of the desert. The objective was to prevent any unnecessary landscape defacement, thereby minimizing the amount of landscape restoration that would be necessary, especially in construction zones.

## 2. Construction Phase.

The construction phase of the esthetic treatment program was designed to help control any unnecessary damage to the environment by limiting disturbances by the contractor to designated areas and by providing for the restoration of areas damaged through actual construction. This phase of the program emphasized the contractor's on-site supervision during which he established an educational rapport with his workers and thus was able to impress on them the importance of environmental preservation.

## 3. Postconstruction Phase.

The postconstruction phase of the program involves maintenance of the site to help assure the success of the esthetic treatment program. When completed, this program will have reshaped and revegetated all project features, except Dike No. 3 and the borrow areas behind Cave Creek and Cave Buttes Dams.

Both the downstream face of the dam embankment and the downstream faces of Dike Nos. 1 and 2 were covered with slope protection material. The esthetic treatment consisted of placing 6 in. (15 cm) of topsoil on the slope protection stone and blending it in a manner that allows the soil to filter into the voids between the stone, exposing the stone in a random manner. Native desert vegetation now grows in the topsoil medium.

On the upstream sides of the dam and Dike No. 2, a 6-in. (15 cm) layer of sandy soil was placed on the revetment of the slopes up to 15 ft (4.6 m) from the top of the dam and dike. This clearance is to remain as open slope protection to break up wave runups. The sandy soil was chosen for ease in water drainage, but still serves the purpose of blending the flood control

structures with their surroundings. The embankments of Cave Creek Road, both upstream and downstream from Dike No. 2, were seeded.

Areas that were seeded and harrowed now support good stands of native shrubs, including four-wing salt bush (Atriplex canescens), quail bush (A. lentiformis), and desert salt bush (A. polycarpa). This is especially noticeable at the borrow area opposite Dike No. 2 and adjacent to the access road leading to Dike No. 1.

The large borrows behind Cave Buttes Dam and Cave Creek Dam still lack a vegetative cover. It is expected that the deposition of silt and seeds from Apache Wash and Cave Creek will eventually result in good stands of native shrubs and herbaceous vegetation in these areas.

In aligning and grading the construction roads, the natural topography and existing site features were considered. Efforts were made to preserve existing plant materials, rock outcroppings, and any other features of interest. When the haul roads were no longer required, they were made impassable to vehicular traffic, their surfaces were scarified and they were left in a condition that facilitates revegetation.

#### D. RESERVOIR OPERATION

Detention of floodwaters in the reservoir area, as well as the release of floodwaters from the dam, are automatically regulated by a 3.75-ft (1.1-m) diameter ungated outlet conduit. The Los Angeles District has installed equipment that will continuously monitor hydrologic data at the damsite. The Flood Control District of Maricopa County is responsible for maintaining this equipment. If significant runoff occurs, personnel from the local operating

agency will be dispatched to inspect the condition of the reservoir and structures and to obtain the accumulated hydraulic and hydrologic data for the event. Plate 4 shows the elevations that the floodwater will reach for identified levels of flooding. For example, a 10-year storm will cause the flood zone to reach an elevation of 1610 ft (491 m) above mean sea level. The length of time required for the floodwater to be discharged from the outlet of the dam depends on the severity of the storm. The approximate number of days that will be required for discharge at Cave Buttes Dam after a given storm is shown in the listing below:

Frequency (year)	Discharge duration (days)
SPF	48
100	37
50	29
25	20
10	12

#### E. PLANS FOR PROTECTION OF ARCHEOLOGICAL RESOURCES

The type of land modification and inundation associated with the flood control project precluded preservation of the majority of cultural resources. Mitigation, therefore, was accomplished through a data recovery program. This program consisted of mapping, excavation and collection of archeological material, data analysis, and preparation of a report. Archeological concerns were coordinated with the Arizona State Historic Preservation Officer and the Advisory Council on Historic Preservation.

# **Construction Status**

Chapter 3  
CONSTRUCTION PROJECT STATUS

The construction of Cave Buttes Dam was completed in December 1979. The elements of this effort that will enhance recreation development are the overlook structure and viewpoint, the trails, the esthetic treatment, and the landscaping. Under a separate contract the access road (Jomax Road) will be widened so that it conforms to Maricopa County specifications for two-way traffic. The Corps of Engineers has received a preliminary letter of intent (App. 1) from the Maricopa County Parks and Recreation Department, and a copy of the letter from the Board of Supervisors authorizing the letter of intent (App. 2). The Board of Supervisors, in a letter of November, 1981, expressed their intent to cost share on development of Cave Buttes recreation facilities as provided in this Master Plan (App. 3).

# **Environmental Resources**



## Chapter 4

### ENVIRONMENTAL RESOURCES

#### A. GENERAL

This section inventories the environmental resources within the Cave Buttes Dam and Cave Creek Wash area and briefly describes each resource.

#### B. CLIMATOLOGY

The project area is located in a typical desert environment, subjected to maximum summer temperatures averaging 105° F (40.5° C) in July and minimum winter temperatures averaging 34° F (1.1° C) in January (pl. 5). There are two rainy seasons. Winter storms occur between the middle of November and the middle of April, and summer storms occur between July and October. Average annual precipitation for the area is 11.4 in. (29 cm), almost 40 percent of which falls during the summer months. Most of the remainder falls between December and March.

#### C. PHYSIOGRAPHY

The project site is in the north central portion of the Sonoran Desert and is characterized by three general topographic zones: mountain, terrace, and inundated basin. The Union Hills, part of a general mountain system that sweeps across the western and southern portion of the project area, are characterized by steep, rugged slopes cut by deep v-shaped drainages. Maximum elevation for the hills is about 2,140 ft (652 m) above mean sea level and 670 ft (204 m) above the streambed.

#### D. GEOLOGY

The damsite at the streambed elevation of 1,570 ft (478 m) spans Cave Creek between two rock ridges that parallel the valley. A thin veneer of older alluvium (talus material) covers the upper slopes of the ridges and becomes much thicker on the east side of the valley near the base of the slope. The materials in the valley are Recent and older alluvium, which consist of various combinations of sand, gravel, cobbles, and some boulders extending to a depth of about 35 ft (11 m). Bedrock forming the ridges and underlying the stream bottom is meta-igneous rock, consisting of moderately hard green schist, greenstone, and granite. There is evidence of ancient folding and some faulting in the rock formations in the vicinity of Cave Buttes Dam.

#### E. HYDROLOGY

Because hydrologic characteristics are not conducive to continuous runoff, little surface flow occurs in the drainage area except during and immediately after periods of heavy rainfall. Future urbanization north of the project area will speed up and increase storm waters flowing into the project area. The rate of infiltration, which varies throughout the project area, is generally high. Under the present situation, water supplies in the Cave Buttes project area are limited to intermittent streamflows, surface flows from the Salt and Verde Rivers, and ground water extracted from wells. The Granite Reef Aqueduct (under construction) of the Central Arizona Project crosses Cave Creek downstream from the damsite.

#### F. GROUND WATER

Ground water depths range from about 300 ft (90 m) near the Arizona Canal to more than 500 ft (150 m) in the northern parts of the valley. The operation of Cave Buttes Dam will not affect the total ground water regime in the area. The potential for localized ground water recharge behind the dam and in the downstream channel will be increased because floodwater will be temporarily detained for release at a controlled rate. The increased duration of flow in the downstream channel may enhance local riparian vegetation. Further studies would be required to determine the suitability of ground water as a source of supply for a lake or pond; if it is acceptable, a water feature could be developed in conjunction with the recreational features as proposed for the Cave Buttes Phase II recreation plan.

#### G. BIOLOGICAL RESOURCES

The Cave Buttes Dam basin contains 1,800 acres (730 ha) of desert wash, desert outwash, and upland vegetation within the standard project flood overflow elevation (pl. 6). The project area supports a variety of wildlife, especially birds. Numerous species of both native and migrant birds have been sighted, especially along Cave Creek Wash. Small mammals such as rabbits, desert mice and rats, gophers, and ground squirrels also can be found in great number.

Project construction has resulted in the alteration and/or loss of some of this natural vegetation and wildlife habitat. Because much of the biota at the damsite is sparse and not unique to the general area, the habitat losses and modifications are not jeopardizing biological communities regionally. The

largest wildlife communities with the greatest species diversity and abundance occupy areas where vegetation is most dense and diversified. Therefore, whenever possible, borrow areas have been sited where desert vegetation is not well developed. These areas have subsequently been restored as much as possible to their original state. Following construction, the disturbed areas were contoured and in some cases seeded to augment re-establishment of the biotic communities. In this way, the impact of the project on local vegetation has been reduced.

Despite these efforts, the impacts were considered significant enough to warrant mitigation for loss of riparian habitat. In total, about 350 acres (142 ha) of desert biota, including 120 acres (49 ha) of riparian habitat, have been removed in the course of construction. The Corps of Engineers and the Flood Control District of Maricopa County as a local sponsor mutually agreed to acquire a 370-acre (150 ha) parcel of land as offsite mitigation downstream from the confluence of the Salt and Gila Rivers; this parcel was designated for such use by the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department. These lands have since been purchased by the Flood Control District as partial compensation for the riparian and desert wash vegetation destroyed by the three dam projects within the New River and Phoenix City Streams project; 55 acres (22 ha) are compensation for habitat destroyed at Adobe Dam, 100 acres (40 ha) for Cave Buttes Dam, and 215 acres (87 ha) for New River Dam.

#### 1. Vegetation.

For its size, the Cave Buttes flood basin has a great diversity of native flora. Both Apache Wash and Cave Creek have a large outwash area in which the

dominant plant is Desert Broom. This area is especially suitable for recreation trails. Just north of Jomax Road is a low area which contains a mesquite bosque. The shade and coolness of this grove will be attractive and inviting to visitors.

On desert terraces in the northern reaches of the basin grow much Creosote, Bursage, and annual grasses. Colonies of Cholla, as well as Palo-verde and Bursage, grow on the lower slopes of the Union Hills, mostly in the eastern portions of the project site. Vegetation populations in the recently excavated borrow areas are still fluctuating. Atriplex species dominate the borrow areas south of Jomax Road. Floods annually inundate the borrow areas north of Cave Buttes Dam. Silt has been deposited in these areas, and attractive herbaceous vegetation grows directly behind the dams.

Indigenous vegetation consists of species characteristic of both the Arizona Upland and the Lower Colorado Subdivisions of the Sonoran Desert Scrub Biome. The following are the more common floral species:

<u>Scientific Name</u>	<u>Common Name</u>
<u>Acacia constricta</u>	White-thorn
<u>Acacia greggii</u>	Catclaw
<u>Celtis pallida</u>	Desert hackberry
<u>Cercidium floridum</u>	Blue paloverde
<u>Cercidium microphyllum</u>	Foothill paloverde
<u>Carnegiea gigantea</u>	Saguaro
<u>Echinocereus engelmannii</u>	Hedgehog cactus

<u>Encelia farinosa</u>	Brittlebush
<u>Ferocactus spp.</u>	Barrel cactus
<u>Franseria deltoidea</u>	Bursage
<u>Larrea tridentata</u>	Creosotebush
<u>Mammillaria microcarpa</u>	Fishhook cactus
<u>Olneya tesota</u>	Ironwood
<u>Opuntia bigelovii</u>	Teddybear cholla
<u>Opuntia spp.</u>	Cholla
<u>Phoradendron californicum</u>	Mistletoe
<u>Prosopis spp.</u>	Mesquite

## 2. Wildlife.

The following faunal species are found in the Cave Buttes project area:

<u>Scientific Name</u>	<u>Common Name</u>
<u>Campylorhynchus brunneicapillus</u>	Cactus wren
<u>Canis latrans</u>	Coyote
<u>Ammospermophilus harrisi</u>	Yuma antelope squirrel
<u>Dipodomys spp.</u>	Kangaroo rat
<u>Gopherus agassizii</u>	Desert tortoise
<u>Lepus californicus</u>	Black-tailed hare
<u>Lophortyx gambelii</u>	Gambel's quail
<u>Odocoileus hemionus</u>	Mule deer
<u>Pecari angulatus</u>	Javelina

<u>Sceloporus</u> spp.	Spiny lizard
<u>Sylvilagus audubonii</u>	Desert cottontail
<u>Taxidea taxus</u>	Badger
<u>Vulpes macrotis</u>	Kit fox
<u>Zenaida asiatica</u>	White-winged dove
<u>Zenaidura macroura</u>	Mourning dove

## H. HISTORY

In August 1921, a major flood along the overflow area of Cave Creek caused a considerable amount of damage to properties in the City of Phoenix. As a result, local interests took immediate steps to prevent a recurrence of flooding. Construction of a dam was initiated in early 1922 and was completed in March 1923 at a cost of \$556,000. The Cave Creek Dam project was financed through a joint effort of the State of Arizona, Maricopa County, City of Phoenix, and other local groups. The dam is located on public domain land.

Cave Creek Dam was placed on the National Register of Historic Places on 22 March 1977. Therefore, in lieu of removal of the dam, a revised plan consisting of an excavated bypass channel was included in the construction contract.

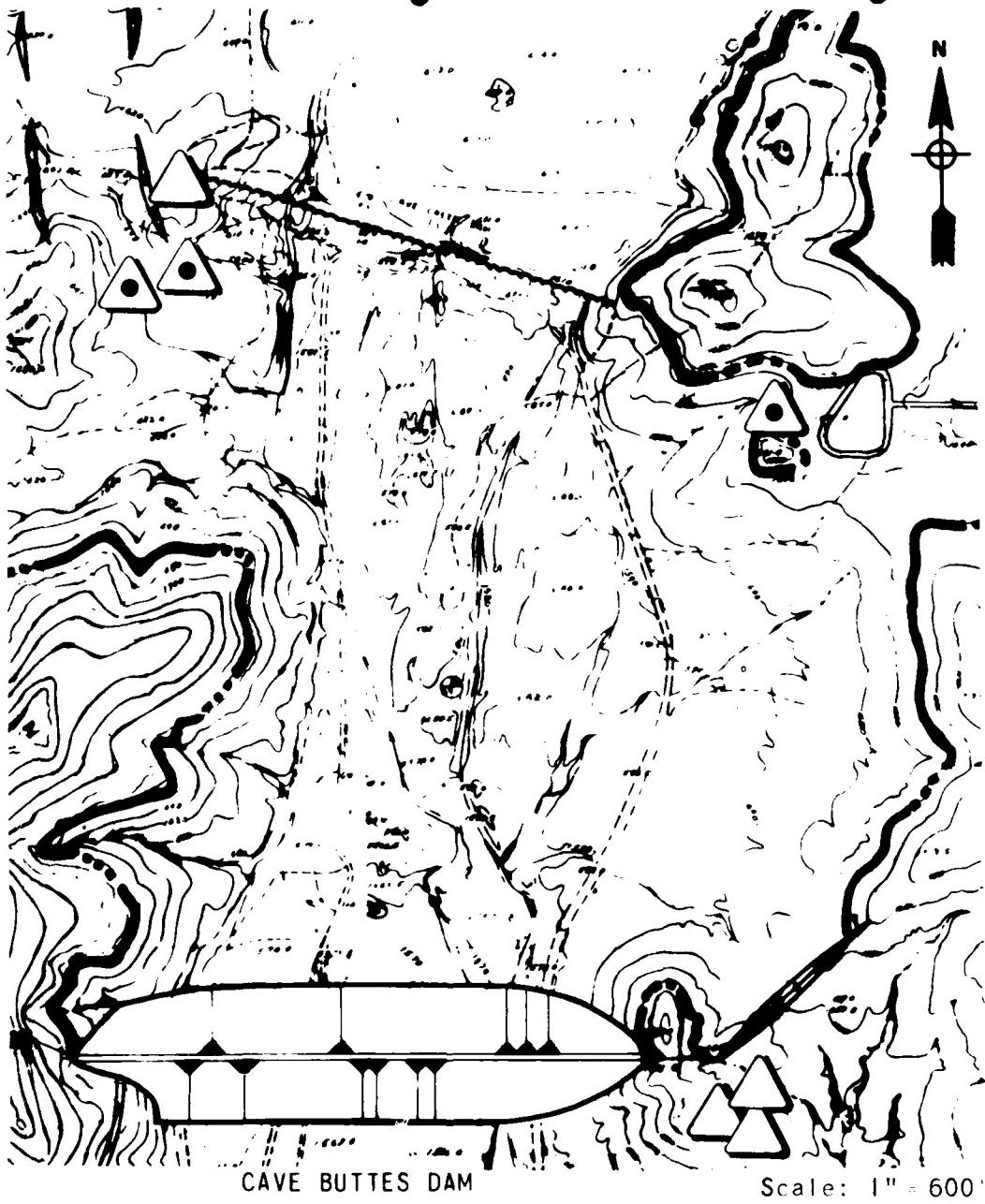
More detailed information on Cave Creek Dam can be found in the Amplification to the Final Environmental Impact Statement, which includes a report on the preservation of Cave Creek Dam.

Several abandoned mining sites comprise another historic resource of the area (Fig. 2). These sites, with their abandoned mine shafts and tunnels, indicate that there were early attempts to mine localized deposits of gold, silver, copper, lead, and slate.

## I. ROADS WITHIN PROJECT AREA

There were several dirt roads within the Cave Buttes project area that were once utilized as service roads by private owners. During dam construction, haul roads were aligned on these dirt roads when practicable to

# Location of Mine Shafts



SHAFTS TO BE FILLED BY CORPS OF ENGINEERS



OTHER SHAFTS

Figure 2

minimize further defacement of the landscape. On completion of construction, all haul roads not planned to be used as maintenance roads were scarified.

#### J. EXISTING LAND USE

Existing land use, as mapped by the Maricopa County Planning Department, lists the Cave Buttes Dam site as desert and mountains (pl. 8). There is a sand and gravel mining operation along the wash just downstream of Cave Buttes Dam. From time to time, topsoil is excavated from designated areas immediately upstream of Cave Creek Dam. Topsoil extraction rights are leased by the Flood Control District of Maricopa County. The Flood Control District also leases grazing rights within the flood basin to cattlemen. Topsoil excavation will continue after recreation development. Grazing activities are expected to cease as the Cave Buttes project area becomes more developed.

The recent growth pattern in Maricopa County has included outward expansion and absorption of neighboring communities into the Phoenix metropolitan area. The Maricopa County Planning Department anticipates that urbanization will spread northward, eventually surrounding the Cave Buttes Dam basin.

#### K. VISUAL QUALITY

The visual quality of the area has been reduced by construction of the project. Although the site for Cave Buttes Dam is remote, the dam and appurtenances are obviously artificial structures that many persons may consider unattractive. Cave Buttes Dam obstructs essentially the same view as Cave Creek Dam. Some areas near the damsite, including some existing sand and gravel mining operations, were used as borrow areas to obtain construction

materials for the dam embankment and dikes. After construction, they were graded and seeded with native vegetation to reduce their visual impact.

There are a few significant views within the Cave Buttes reservoir that add to the visual esthetics of the area (pl. 9). The overlook structure provides an excellent vantage point for viewing the two dams and the entire basin. From the sundial slab, hikers can take advantage of a 360° panoramic view of the natural desert vegetation and surrounding mountains. Looking north from any point in the basin area, a series of mountain ranges form dramatic patterns against the sky.

# **Social and Economic Factors**

## Chapter 5

### SOCIAL AND ECONOMIC FACTORS

#### A. GENERAL

This section presents an overall view of the social and economic factors considered in the formulation of the master plan. These include: area of influence, demographic considerations, accessibility of the recreation resource, a sociological perspective, and visitation, which is a profile of user needs and preferences.

#### B. AREA OF INFLUENCE

The area of influence or recreation market area defines the geographic region from which visitors will travel to participate in recreation. The recreation market area (pl. 10) is delineated by five concentric circles around a point central to the four damsites that make up the New River project. This breakdown exhibits the primary influence associated with the New River and Phoenix City Streams project. The estimated population distribution for 1980 within the five concentric circles is tabulated below.

<u>Distance from project centroid in miles (km)</u>	<u>Approximate zone population</u>
0-10 (0-16)	36,000
10-20 (16-32)	1,106,000
20-30 (32-48)	244,000
30-40 (48-64)	40,000
40-50 (64-80)	14,000

Of the 1,440,000 people who live in the market area, approximately 1,386,000 (96 percent) live in Maricopa County. For ease of statistical collection, therefore, Maricopa County will be considered the primary market area.

Use from outside of Maricopa County by residents of Pima, Yavapai, Coconino, Navajo, and Apache Counties does have a measurable impact on many of the outdoor recreation activity categories within the county. Non-residents of the State make a fairly heavy utilization of this county's recreation resources as well. However, according to the 1978 Arizona Statewide Comprehensive Outdoor Recreation Plan, 80 to 100 percent of all outdoor recreation activities occurring in Maricopa County can be attributed to residents of the county.

#### C. DEMOGRAPHIC CHARACTERISTICS

The Arizona Department of Economic Security (DES) has prepared figures<sup>1</sup> for the projected population growth of Maricopa County, as shown in the listing below:

1980	.....	1,436,000
1985	.....	1,621,900
1990	.....	1,831,600
1995	.....	2,077,200
2000	.....	2,352,300

<sup>1</sup> These figures were used instead of the more typically referenced Bureau of Economic Analysis 1980 OBERs projections (1985: 1,555,300; 1990: 1,693,600; 2000: 1,932,500) because the 1980 census results indicate that the higher DES figures are more accurate.

From 1900 to 1970, population in Maricopa County increased from approximately 20,000 to more than 969,000, which is an increase of 4,745 percent. The period of high population growth began in the 1940's and has continued, more or less steadily, to the present; most of the county increase has occurred in the Phoenix urban area. A recent population estimate prepared by the Maricopa County Planning and Zoning Department indicates that since 1970, population has increased at an average annual rate of about 7 percent.

The unprecedented population growth of the past three decades, as well as the continued growth that is estimated for the future, signifies a need and demand for more park facilities. Agencies involved in forecasting Maricopa County's population growth predict a decreasing rate of growth for the market area. Nonetheless, the growth rate is expected to exceed that of the nation as a whole. Projections for 1990, prepared in 1979 by the Maricopa Association of Governments, indicate a continued increase in population density in the Phoenix metropolitan area and an expanding low-density development northwest of the city. By 1990, the Phoenix urban area may extend to just south of Happy Valley Road and the Black Canyon Freeway (Interstate 17) and east to the McDowell Mountains. Existing scattered urbanization along Apache Trail and the proposed Superstition Freeway probably will be consolidated and extended to the county line. Urban development may eventually extend south to the Gila River Indian Reservation and east to include Chandler and Gilbert.

Population density within the market area varies considerably. Central Phoenix has a residential density of about 10 persons per acre, whereas the population density in the Phoenix Mountains and on Indian reservations is less than one person per acre.

The Phoenix metropolitan area is currently undergoing considerable construction and expansion. Most new housing developments are pushing to the northwest and southeast of the urban center. As construction spreads north and west, better roads will be built, providing convenient access to areas immediately surrounding the proposed detention basin recreation areas.

#### D. ACCESSIBILITY

The Cave Buttes Dam basin is approximately a 40 minute drive from downtown Phoenix, the most direct route being 7th Street north to Cave Creek Road. Jomax Road currently provides access to the basin. The road is a one lane, paved road designed for maintenance use only. The pavement width will soon be expanded to 22 feet; it can then be used as a two lane public road accessing the existing overlook structure. The cost for widening Jomax Road is considered a project construction cost.

Jomax Road ends at the overlook structure parking lot. From here, unpaved maintenance roads extend to Dike No. 1, the main embankment, and the spillway. Access to other portions of the detention basin is very difficult. While all of the basin is accessible to pedestrians, some areas are difficult to reach by car; vehicular access is virtually impossible when the ground is muddy. In order to develop the recreation potential of the Cave Buttes Dam basin, an all weather loop road providing access to all portions of the basin is essential.

#### E. SOCIOLOGICAL PERSPECTIVE

The Phoenix metropolitan area enjoys a strategic location in the fast-growing Southwest. Climate, job opportunities, nearby major recreation areas,

and a strong retirement appeal have caused a population surge in this area in recent decades. With an increase in population, there is a concomitant increase in demand for recreation facilities.

Because recreation facilities serve people, the leisure needs and preferences of people should be identified in the planning process. The demographic characteristics of the project area indicate that the users are basically urban consumers from the Phoenix metropolitan area, which comprises 55 percent of the State's total population. Urban areas make specific demands upon open space development. Planning of recreation resources should recognize the needs and desires of the users that the recreation areas are designed to serve.

#### F. VISITATION

A survey was conducted by the Arizona Outdoor Recreation Coordinating Commission (AORCC) in 1978 to determine the outdoor recreation interests of the people of Arizona. The 10 most important facility needs for year-round outdoor recreation activities for state residents are picnicking, tennis, baseball/softball, bicycling, handball/squash/racquetball, waterskiing, rafting/tubing, river or lake swimming, nonpowered boating, and pool swimming. Non-residents of Maricopa County participated most often in the following: back-country hiking, court and field games, and vehicle-related activities. The Cave Buttes Dam recreation area will accommodate some of those activities enjoyed most by both residents and tourists.

Table 2 demonstrates how Cave Buttes' recreation provisions will help satisfy recreation demand in Maricopa County. The projected visitation that is expected at Cave Buttes, by activity, is compared with current unmet demand. Table 2A provides similar information for Cave Creek Park from the ACDC to Peoria Ave.

Table 2 - Comparison of Estimated Annual Project Supply with Existing Unmet Demand (in Recreation Days)

<u>Activity</u>	<u>Present Demand</u>	<u>Existing Supply</u>	<u>Unmet Demand</u>	<u>Project Supply</u>
Picnicking <sup>1</sup>	13,372,000	5,400,000	7,972,000	67,200
Horseback riding	3,198,000	173,000	3,025,000	18,000
Hiking	8,721,000	117,000	8,604,000	16,200
Camping <sup>1</sup> (Group, RV & primitive)	3,779,000	682,000	3,097,000	25,000
Hot air ballooning, participants	11,000	7,000	4,000	6,000
Hot air ballooning, spectators	5,000	3,000	2,000	2,400
Cross country eques., participants	2,000	0	2,000	2,000
Cross country eques., spectators	1,000	0	1,000	800
Cross country eques., training	7,000	0	7,000	6,600
Pointer dog training	99,000	0	99,000	9,000
Retriever dog training	4,000	0	4,000	2,700
Model airplane	25,000	10,000	15,000	16,200
Lake fishing <sup>2</sup> (shore)	5,523,000	2,500,000	3,023,000	78,900
Non-power boating <sup>2</sup>	2,471,000	365,000	2,106,000	4,300
Target Archery <sup>2</sup>	1,163,000	263,000	900,000	28,900
Field Archery <sup>2</sup>	totaled with above	totaled with above	totaled with above	50,400
Turfed multiuse areas	Localized market area makes existing demand data not applicable			61,380
Paved multiuse areas				46,680
Jogging				10,000
<b>Totals</b>	<b>38,381,000</b>	<b>9,520,000</b>	<b>28,861,000</b>	<b>453,000</b>

<sup>1</sup>Phase I & Phase II

<sup>2</sup>Phase II

Table 2A - Comparison of Estimated Annual Project Supply with Existing Unmet Demand (in Recreation Days) for Cave Creek Regional Park, Peoria Ave. to the ACDC.

<u>Activity</u>	<u>Present Demand</u>	<u>Existing Supply</u>	<u>Unmet Demand</u>	<u>Project Supply</u>
Picnicking	13,372,000	5,400,000	7,972,000	75,000
Horseback riding	3,198,000	173,000	3,025,000	18,000
Hiking	8,721,000	117,000	8,604,000	600
Cycling	20,203,650	*	—	900
Turfed multiuse area				18,000
Paved multiuse area	Localized market area makes existing demand data not applicable			15,000
Jogging				1,400
Nature study center	8,721,000	216,000	8,505,000	49,900
<b>Totals</b>	<b>54,215,650</b>	<b>5,906,000</b>	<b>28,106,000</b>	<b>178,800</b>

\*Difficult to quantify supply due to the local nature of these facilities.

# **Factors Influencing Development**

---

## Chapter 6

### FACTORS INFLUENCING AND CONSTRAINING RESOURCE DEVELOPMENT AND MANAGEMENT

#### A. GENERAL

Geology, soils, and materials investigations were conducted to determine the extent, distribution, and physical properties of the rock and soils at the site of the Cave Buttes Dam, dikes and appurtenances. This detailed information on the foundation, construction materials, and ground water conditions provided a sound basis for the design of the structures, as well as for proposed recreation facilities. This section discusses elements (e.g., geology, topography) as they affect development at the site.

#### B. CLIMATOLOGY

The climate in the project area is summarized in chapter 4, section B. The arid and subtropical climate in the project area is conducive to year-round recreation. The predominately clear skies and characteristically dry atmosphere permit intense surface heating during the day and active radiational cooling at night. This produces diurnal temperature variations that average 30° F, allowing evening recreation activities during most of the year.

#### C. PHYSIOGRAPHY

The topography of the region has been altered since 1923 by the impoundment of sediment behind Cave Creek Dam. A 5700 acre-ft (703 ha-m) storage capacity has been allocated behind Cave Buttes Dam for the

accumulation of sediment over the designed project life of 100 years. Cave Creek is the highest order stream, with Apache Wash and Rowler Wash its most important tributaries. Cave Creek flows in a general southwesterly direction from its headwaters to the dam, a distance of about 25 mi (40 km).

#### D. GEOLOGY

The geology within the project area will not affect development at the site. Detailed geologic information can be found in Appendix 1A of the Cave Buttes Dam General Design Memorandum - Phase II.

#### E. SEISMICITY

The project site is in Zone 2 of the Seismic Risk Map of the United States (Earthquake History of the United States, U.S. Department of Commerce, 1970). An evaluation of the geologic and seismic conditions within a 150-mi (240 km) radius of the project site indicates that the proposed recreation facilities are in an area of low seismicity; therefore, earthquakes present no problem to development plans for the area.

#### F. SOILS LIMITATIONS

A knowledge of the characteristics of local soils is necessary in order to properly plan, develop and maintain recreation areas. The soils within the project area have been rated according to limitations that affect their suitability for camp areas, picnic areas, paths and trails, and field sports. Table 3 rates the soils as having slight, moderate, or severe limitations for the uses specified. A slight limitation means that soil properties are generally favorable. A moderate limitation can be overcome or

modified by planning, design or special maintenance. A severe limitation means that costly soil reclamation, special design, intensive maintenance, or a combination of these is required.

Table 3. Soils Limitations for Recreation Development

<u>Type of Soil</u>	<u>Areas</u>			<u>Field Sports</u>	<u>Paths and Trails</u>
	<u>Camp</u>	<u>Picnic</u>	<u>Playground</u>		
Antho Carrizo Complex	Slight	None to slight	None to slight	Moderate	None to slight
Carefree-Beardsley Complex	Moderate	Moderate	Moderate	Moderate	Moderate
Carefree-Cobbly Clay	Moderate	Moderate	Moderate	Moderate	Moderate
Cipriano Very Gravelly Loam	Moderate	Moderate	Moderate	Severe	Moderate
Contine Clay	Moderate: slow permeability	Moderate	Moderate: slowly permeable subsoil	Moderate	Moderate
Ebon Gravelly Clay Loam	Severe: 50 to 90% gravel and cobbles	Severe: 50 to 90% gravel and cobbles	Severe: 50 to 90% gravel and cobbles	Severe: more than 50% gravel and cobbles; bedrock at a depth of less than 20 in.	Severe: more than 50% gravel and cobbles; bedrock at a depth of less than 20 in.
Gachado-Cherioni-Rock Outcrop Complex	Severe: more than 50% gravel and cobbles; bedrock at a depth of less than 20 in.	Severe: more than 50% gravel and cobbles; bedrock at a depth of less than 20 in.	Severe: more than 50% gravel and cobbles; bedrock at a depth of less than 20 in.	Severe: more than 50% gravel and cobbles; bedrock at a depth of less than 20 in.	Severe: more than 50% gravel and cobbles; bedrock at a depth of less than 20 in.
Gilman Loam	Slight	Slight	Slight	Slight	Slight
Glenbar Loam	Moderate: slow permeability	Slight	Moderate: slow permeability	Slight	Slight
Mohall Loam	Moderate: slow permeability	Slight	Moderate: slow permeability	Slight	Slight

Table 3. (Continued)

<u>Type of soil</u>	<u>Camp</u>	<u>Picnic</u>	<u>Areas</u>		<u>Paths and Trails</u>
			<u>Severe</u>	<u>Severe</u>	
Pinamt-Tremant Complex	Severe	Severe	Severe	Severe	Severe
Sun City-Cipriano Complex	Severe: more than 50% coarse fragments; very slow permeability; hardpan at a depth of less than 20 in.	Severe: more than 50% coarse fragments; hardpan at a depth of less than 20 in.	Severe: more than 50% coarse fragments; hardpan at a depth of less than 20 in.	Severe: more than 50% coarse fragments; hardpan at a depth of less than 20 in.	Severe: more than 50% coarse fragments; hardpan at a depth of less than 20 in.
Tremant Sandy Loam	Moderate	Slight	Severe	Slight	
Tremant-Toltec Complex	Moderate	Moderate	Severe	Moderate	

Soil permeability is the property of a soil horizon that enables water or air to move through it. Classes of permeability used in this survey refer to the percolation rates in the listing below:

<u>Class</u>	<u>Inches per hour</u>
Very Slow	Less than 0.06
Slow	0.06 to 0.20
Moderately Slow	0.20 to 0.63
Moderate	0.63 to 2.00
Moderately Rapid	2.00 to 6.30
Rapid	6.30 to 20.00
Very Rapid	Over 20.00

#### G. ARCHEOLOGICAL SITES

Man's presence in Arizona begins about 10,000 B.C. with the appearance of Paleo-Indian or big game hunting people. During this time small bands followed the herds, hunted bison and mammoth and collected wild plant resources. Paleo-Indian artifacts have been found in a number of Arizona locations, but, none have yet been found in the Cave Buttes area.

Following the Paleo-Indians were small groups of non-sedentary hunter-gatherers known as the Desert culture. It is believed that their lifestyle, which utilized a wide variety of wild plant and animal food, developed out of the Paleo-Indian big game hunting pattern as an adaptation to a period of aridity that occurred sometime around 6000 B.C. Some artifacts representing the Desert culture have been found in the project area.

The Hohokam culture, which appeared around 350 B.C., is the final major prehistoric development in southern Arizona; it is also the main focus of interest in the Cave Buttes area. The Hohokam present a challenge to students of prehistory because they had a subsistence pattern that featured agriculture, pottery, and settled communities; these were all major innovations in an area where people had lived as hunter-gatherers for thousands of years. The Hohokam disappeared during the first half of the 15th century. The origins of this culture have been the subject of controversy for years. It is now generally agreed that the Hohokam lifestyle developed as the result of migrants from Mexico bringing agriculture to the indigenous desert people.

Cave Buttes was not occupied by the Hohokam until circa A.D. 1000. This period of Hohokam prehistory was marked by population growth and expansion from the major tributary drainages of the Gila and Salt Rivers into minor drainages such as New River and Cave Creek. Thus the Hohokam families occupying Cave Buttes entered the area as pioneers colonizing a new territory. This area did not have the quantities of arable land, regularity of water supply, and density and productivity of wild food products that were available in the larger drainages farther to the south. The archeologic evidence indicates that a variety of subsistence techniques was developed to meet this challenge. These techniques included irrigation agriculture, dry farming techniques, and the procurement of seasonally available wild foods.

Fort Mountain was the focus for the Hohokam within the Cave Buttes area. The settlement consisted of masonry structures resembling fortifications atop the mountain and a complex of farmsteads at its base and extending up Cave

Creek. Limited activity sites, such as rock quarries and seasonal hunting and collecting camps, are dispersed throughout the area. The area in the vicinity of the dam contains many of these special activity areas, as well as some field houses (houses located by agricultural fields) and agricultural features. Sometime around A.D. 1150 the Hohokam abandoned Cave Buttes, leaving the remnants of farms and field houses, pit houses, masonry structures, field systems, canals, and check dams, as well as sherd and lithic scatters, shell ornaments, and petroglyphs.

Researchers working to discover how this culture developed and why it disappeared believe that the archeologic remains left by the Hohokam at Cave Buttes and other marginal areas reflect attempts to counteract population and environmental problems and may provide some of the answers as to why they vanished. It has been suggested that changes in climatic conditions and deterioration of the local environment, at least partly brought about by the Hohokam themselves, may have been significant factors. With the disappearance of the Hohokam culture there is a hiatus of about 300 years in the archeological record. It is probable that the Pima and the Papago who inhabited the region at the time of Spanish contact were the cultural descendants of the Hohokam, but this information is not within Pima and Papago oral history. The Cave Creek Archeological District in central Arizona is shown in Fig. 3.

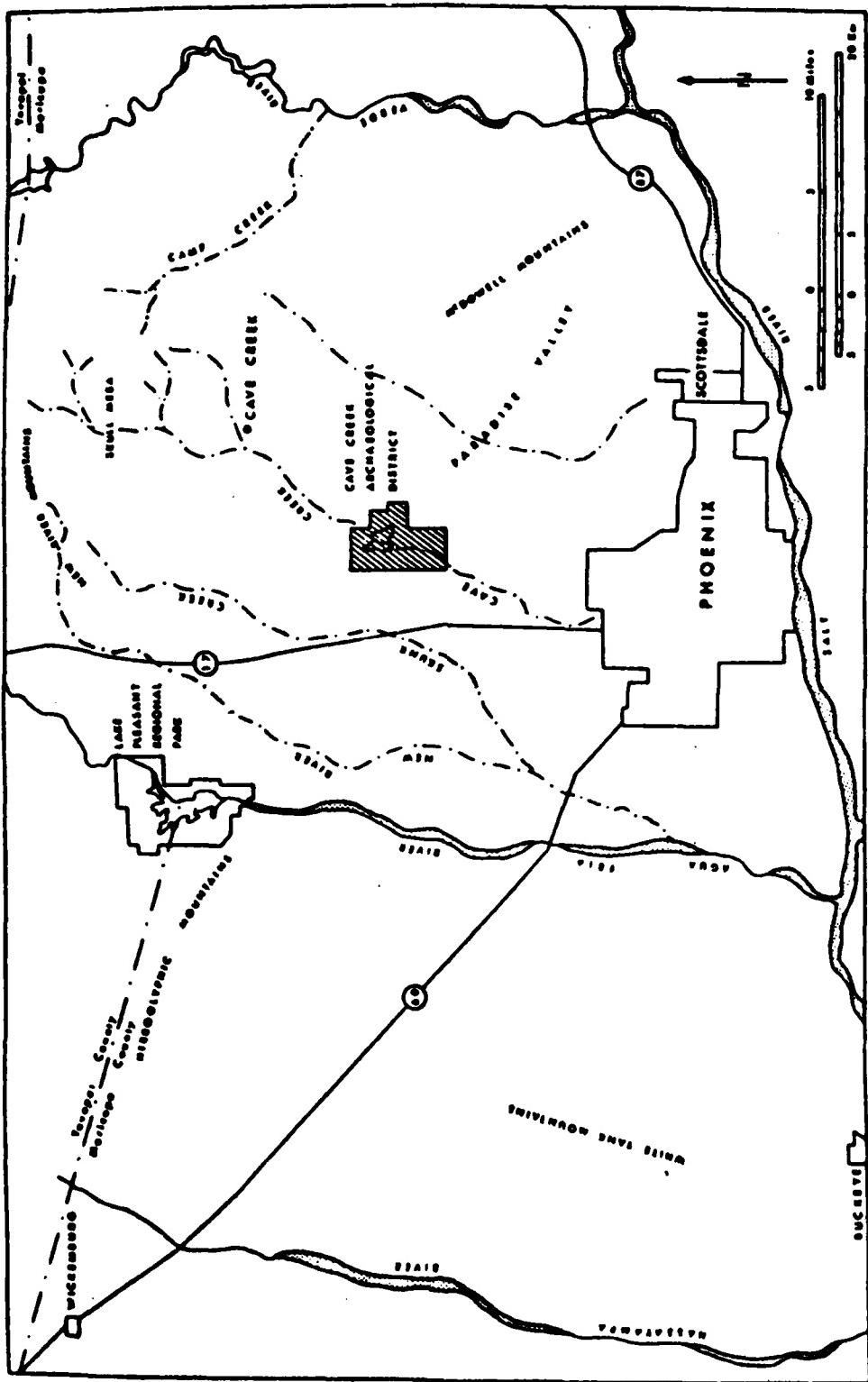


Fig. 3 Location of the Cave Creek Archaeological District in Central Arizona.

## H. LOCAL RECREATION AREAS

The Phoenix metropolitan area is encircled by a system of regional and semiregional parks, all of which are within a 1-hour drive of central Phoenix. Although more than half of the nearly 113,000 acres (45,750 ha) in these parks is not developable for recreation use, most of the parks do provide some picnicking and camping facilities.

Other cities within the market area have smaller parks; generally, they are neighborhood or community parks. The 1978 Arizona Outdoor Recreation Coordinating Commission (AORCC) Statewide Comprehensive Outdoor Recreation Plan states the following:

Outdoor recreation in Maricopa County is predominantly urban oriented as expected from the large metropolitan center present..... As the cost of travel goes up with increasing fuel costs there may be more need perceived by the "public" for these types of facilities nearer to the urban metropolitan area. As handicapped and urban minorities become more active in outdoor recreation there may be additional pressure to develop more of the "urban alternatives" (pg 38-39).

Table 4 presents an inventory of existing regional parks in Maricopa County. Table 5 lists the semiregional parks scheduled for development by Maricopa County and the City of Phoenix.

Table 4. Inventory of Regional Parks in Maricopa County

<u>Jurisdiction/Name</u>	<u>Total</u>	<u>Acres</u>	<u>Potentially Developable</u>
		<u>Developed</u>	
<b>Phoenix:</b>			
Camelback Mountain Park	474.79	10.00	0
Phoenix Mountains Preserve	7,700.00	25.00	200.00
Papago Park	888.64	820.61	0
South Mountain Park	15,700.07	800.00	0
Cave Creek Park & Scenic Drive	481.10	0	481.10
Encanto Park	61.01	61.01	0
Esteban Park	64.08	64.08	0
Alvord Park	346.00	0	346.00
<b>Maricopa County:</b>			
Black Canyon Shooting Range	1,433.70	1,000.00	200.00
Buckeye Hills	4,473.90	200.00	2,000.00
Casey Abbott Park	2,124.06	600.00	1,500.00
Cave Creek	3,002.50	0	1,500.00
Thunderbird	726.68	50.00	300.00
Usery Mountain	3,324.24	300.00	3,000.00
Estrella Mountain	16,467.91	0	8,000.00
Lake Pleasant	14,396.00	400.00	4,000.00
McDowell Mountain	20,941.73	140.00	14,000.00
White Tank Mountain	26,331.00	700.00	12,000.00
Paradise Valley Park	340.00	160.00	180.00
Spook Hill Recreation Area	267.40	5.00	262.40

Table 4 (Continued)

<u>Jurisdiction/Name</u>		<u>Acres</u>	
	<u>Total</u>	<u>Developed</u>	<u>Potentially Developable</u>
<b>Scottsdale:</b>			
McCormick Park	30.00	30.00	0
Chaparral Park	74.00	74.00	0
Eldorado Park	55.00	55.00	0
Vista Del Camino Park	40.00	40.00	0
McDowell Mountain Park	1,280.00	0	200.00
<b>Tempe:</b>			
Papago Park	450.00	56.00	0
Kiwanis Park	125.00	90.00	35.00
<b>Wickenburg:</b>			
Constellation Park	288.00	30.00	258.00

Table 5. Recreation Facilities Proposed for Development by Maricopa County and the City of Phoenix

<u>Facility Name</u>	<u>Location</u>	<u>Acreage</u>	<u>Activities Provided</u>
Phoenix Mountains Preserve	Immediately north of the Phoenix urban area	9,711	Picnicking; hiking; bicycling and equestrian trails; amphitheater; nature center
Deem Hill Park and Skunk Creek Recreation Area	North and north-east of the City of Phoenix	1,300	Picnicking; camping; trails
Union Hills Park	North of the City of Phoenix and just south of Cave Buttes Dam site	800	Camping; picnicking; trails
Reach 11 of Central Arizona Project	North of the City of Phoenix along the Granite Reef Aqueduct of the Central Arizona Project	2,000	Fairground; college campus; court and field game facilities; equestrian center

## I. APPLICATION OF PUBLIC LAW 89-72 AND OTHER LEGISLATIVE OR ADMINISTRATIVE REQUIREMENTS FOR COST SHARING

The Office of the Chief of Engineers has established a policy for recreation development at Federal nonreservoir water resource projects that is consistent with the Congressional intent expressed in the Federal Water Project Recreation Act of 1965 (Public Law 89-72). In accordance with this authorizing legislation, all new recreation developments not approved prior to passage of the law require local sponsorship. This requires an agreement with a non-Federal agency that local interests will:

- o Provide fee title or appropriate leases to all lands, other than access roads, that are needed for recreation development and are required to ensure public control of the development, with appropriate credit, as given below.
- o Where the appraised value of the land so provided amounts to less than 50 percent of the total first cost of the recreation development, make additional contributions sufficient to bring the non-Federal share to at least that level; these additional contributions may consist of the actual cost of carrying out an agreed-on portion of the development, or a cash contribution, or a combination of both.
- o Operate, maintain, and replace without expense to the Federal Government the recreation areas and all facilities installed pursuant to the agreement.

**Coordination**

## Chapter 7

### COORDINATION WITH OTHER AGENCIES

During development of the master plan for the Cave Buttes Dam basin and Cave Creek Wash, close and continuous coordination has been maintained with Federal, State, and local agencies that have interests and responsibilities in the fields of public recreation, fish and wildlife, preservation of archeologic and historic resources, and environmental quality. A multiagency recreation task force was formed in September 1973 for the purpose of planning and coordinating recreation development associated with the New River and Phoenix City Streams flood control project. The task force is composed of representatives of various Federal, State, and local agencies and interest groups, including the following:

U.S. Army Corps of Engineers  
U.S. Bureau of Reclamation  
U.S. Fish and Wildlife Service  
U.S. Soil Conservation Service  
Arizona Game and Fish Department  
Arizona Outdoor Recreation Coordinating Commission  
Arizona State Horsemen's Association  
Arizona State Land Department  
Arizona State Parks Department  
Arizona Water Commission  
Flood Control District of Maricopa County  
Maricopa County Parks and Recreation Department  
Maricopa County Planning Department  
Avondale Parks and Recreation Department  
Glendale Parks and Recreation Department  
Mesa Parks and Recreation Department  
Peoria Parks and Recreation Department  
Phoenix Parks, Recreation, and Libraries Department  
Tempe Parks and Recreation Department  
Deer Valley Community Council  
Deer Valley Planning Committee  
Jade Park North Homeowners' Association  
Saddleback Meadows Homeowners' Association

The task force has been instrumental in the formulation of the overall land use concepts and development plans for the Cave Buttes Dam basin and Cave Creek Wash. In addition to the close coordination with the recreation task force, the development plan has been presented to the Citizens' Advisory Board of the Flood Control District of Maricopa County, Arizona Hiking and Equestrian Trails Committee, Maricopa County Hiking and Riding Trails Committee, Maricopa County Parks and Recreation Commission, Deer Valley Planning Committee, City of Phoenix Parks and Recreation Board, the Phoenix City Council, and numerous citizens' committees.

The advice and expertise of the following persons were also utilized in developing plans for various facilities within the Cave Buttes Dam basin and Cave Creek Wash: an experienced hot air balloonist, president of the Phoenix Hot Air Balloon Club; an archer, president of the Hon-Dah Archers, Inc.; dog trainers of the Phoenix Retriever Group and of the German Short-Haired Pointer Club; personnel of the Deer Valley Airport traffic control tower; representatives of the Phoenix chapter of the U.S. Combined Training Association; and the Eastern Paralyzed Veterans of America.

Coordination with the recreation task force and other interested parties will be continued through all future phases of development and implementation of the Cave Buttes Dam basin and Cave Creek Regional Park development plan.

# **Physical Plan**

## Chapter 8

### PHYSICAL PLAN OF DEVELOPMENT

#### A. GENERAL

This section describes the general land use allocation of the basin area, including both existing uses and uses that are expected to appear in the near future (pl. 8 and 11).

#### B. LAND USE PLAN

The Cave Buttes Dam recreation area is just upstream from Cave Buttes Dam, about 18 mi (30 km) north of Phoenix, whereas the proposed Cave Creek Regional Park extends south from the downstream base of Cave Buttes Dam about 11 mi (18 km) to the proposed Arizona Canal Diversion Channel. These recreation sites are located in an open space area with general rural areas to the east, north, and west, and an urban area to the south (pl. 8).

General rural areas are defined as lands that are predominantly vacant or used for nonurban uses, including low-density residential and agricultural areas. The urban area is defined as that portion of the larger metropolitan area that is required to support future urban development and is scheduled for redevelopment. This area will contain the bulk of current and future urban growth. Because Phoenix is expected to continue its rapid expansion toward the project area, an urban park has been planned for Cave Creek in the Phase II plan for Cave Buttes Reservoir.

Recreation development has been designed for the Cave Buttes basin to ensure that the various activities are mutually compatible and are suited to the topography of the area. For example, because the area just upstream from Cave Creek Dam is relatively flat, the more intensively used Phase II facilities would be located here, out of the Cave Creek wash and outwash areas (pl. 13). These facilities - which include paved and turfed multiuse areas and picnic facilities - will be conveniently located in a centralized area around the boating and fishing portion of the proposed lake.

Less intensive development that depends more on the natural terrain will be located in the outlying regions of the basin. Camping is proposed several hundred yards upstream from the wildlife/boating and fishing lake and will be adjacent to the east side of Cave Creek Wash. A nearby minimal equestrian center is proposed to take advantage of the natural trails in neighboring washes. Recreation in the hills to the west of the basin is restricted because of the steep terrain, but a field archery course will be suitable for this area. Because of its vegetation and topography, the area immediately north of Cave Buttes Dam is suitable for the training of retriever dogs, as well as for hiking and riding. The expanse of open land just east of the Union Hills is also appropriate for hiking and riding; in addition, hot air ballooning, combined training events, and bird dog training are sited here. The following section describes specific plans for the activities that are proposed for the basin.

#### C. RECREATION

The recreation market area for the New River and Phoenix City Streams project lies within a 50-mi (80 km) radius of a point central to the four dam

sites comprising the project. Picnicking, camping, horseback riding, and water-oriented activities such as boating and fishing are very popular among residents of the market area and among tourists as well. Yet fewer than 5,400 acres (2,185 ha) of the nearly 113,000 acres (45,730 ha) of regional park within the market area are developed to accommodate these activities. There are only five large lakes within 50 mi (80 km) of the Phoenix area that provide facilities for fishing and boating.

Implementation of the Cave Buttes Dam recreation plan would help meet the increasing demand for recreation facilities in Maricopa County. At present, there is one formal facility within the project area, which includes Cave Creek Wash from Cave Buttes Dam to the proposed Arizona Canal Diversion Channel. This facility is a golf driving range at Greenway Road and 19th Avenue. There are indications that the project area is utilized for sightseeing, horseback riding, hiking, hunting, and outdoor recreation vehicle use, but people must trespass in order to enjoy these activities. Within the Cave Buttes basin a variety of recreational opportunities will be provided at different times, depending on the demand and funds available for construction of the recreational facilities. As urban expansion continues, the basin area will become increasingly important as a permanent reserve for open space recreation.

The Cave Buttes area is also currently used for informal equestrian activities. Horse-lot residential properties are located north and east of the site, and Cave Creek, known locally as "horse alley", is used as a connecting route to riding trails north of the basin area.

Trails leading out of the south end of the basin will proceed downstream from Cave Buttes Dam along Cave Creek Wash, eventually linking with the Sun Circle Trail at Dunlap Avenue, just south of Peoria Avenue. The Sun Circle Trail is the focus of the region's trail system. A network of primary trails connects all urban areas and regional parks in Maricopa County to the 110-mi (177-km) Sun Circle Trail. This network contains approximately 600 mi (965 km) for a countywide total of 710 mi (1,142 km) of riding and hiking trails.

#### D. PHASE I RECREATION DEVELOPMENT

Recreation facilities at the Cave Buttes project area will be developed in two phases. The cost of construction for Phase I is estimated at \$1,279,300, with an annual operation and maintenance (O&M) cost of \$74,900. The O&M cost was calculated by Maricopa County Parks and Recreation Department and has been updated to January 1982 price levels. It is based on the county's present-day O&M costs for existing recreation areas with similar types of facilities. Under Phase I, initial development, the recreation area will be considered a regional park (pl. 14). Most of the recreation facilities will scar the landscape only minimally and will have low operation and maintenance requirements. Activities proposed for Phase I development are described in the following subsections.

##### 1. Multiuse area (unturfed).

Approximately 1 mi north of Cave Creek Dam, a small area will be cleared and graded level, allowing for a variety of informal activities. This area will be appropriate for outdoor exhibits and events, including soccer, art

shows, dog shows, and hot air balloon launching. Because of noises created by various expected activities, the multiuse area will be located a considerable distance from the archery range (Phase II) and from the equestrian center. Parking for 40 cars will be developed adjacent to the field.

This site is about 4 mi (6 km) northeast of Deer Valley Airport, within the 5 mi (8 km) radius established by the airport for non-interference with their air traffic. A meeting was held with Deer Valley Airport tower representatives to discuss, from an air traffic control standpoint, what impact balloon launching from the project area might have on this general aviation airport. It was stated that this site will be used during the months of September through May, with heaviest use occurring on weekends. Departures will normally take place in the morning and proceed northbound away from Deer Valley Airport. Balloon launchings from the proposed site will not endanger aircraft using the airport, especially if the balloon flights are restricted to the area north of Cave Buttes reservoir. Final word from the airport's regional office was a verbal approval to allow the balloonists to launch from the proposed launch site. Development of this multiuse area is cost shareable. In Phase II this area will be improved with the installation of irrigation and turf.

## 2. Equestrian Center.

About 300 acres in the northern part of the dam basin will be officially designated as an open riding and training area. An equestrian center with minimal facilities is planned in the middle of this area. Features of the center will be an open bladed area, training oval, seating, and a parking area for 40 cars. This center will serve as the site for the dressage and

steeplechase events or combined training competitions to be held occasionally at the project site. During such times, portable fences, corrals, bleachers, and other items may be temporarily installed. Riding clubs could use this center as a meeting place and point of departure for organized trail rides. The open bladed area, parking, and hitching posts are cost shareable.

### 3. Combined training.

The equestrian center and the 300 acres of natural area will double as a combined training (also called three day eventing) area. Combined training is a sport pursued by many equestrian enthusiasts. Using three events, combined training tests the abilities of horses and riders. Dressage (the first day's event) and jumping (the third day's event) will take place at the equestrian center. Here, a small horse arena consisting of temporary, portable fences and barriers on a suitably prepared surface will be adequate for the competition. Additional space will be used for horse trailer parking, horse grooming, and spectating.

The speed and endurance trial (the second day's event) will take place in the natural area to the west. A number of permanent jumps will be constructed throughout this area. The jumps will be adjacent to trails that horses and riders will follow, both in training situations and in competition. The jumps will be designed with natural materials to blend in with the desert and desert wash landscape. Some jumps could be designed with water basins, which would be filled at the time of competitions. Unschooled horses will usually refuse to attempt these jumps. However, to minimize the possibility of unauthorized riders and horses attempting the jumps and thus risking injury, chains or other obstacles will be placed over the jumps when they are not in use.

Warning signs will be posted as a further precaution. Maricopa County Parks and Recreation Dept. will be responsible for safely managing the jumps. Trails, parking areas, and other support features are cost shareable items.

4. Picnic Area.

Picnic facilities are planned in a centrally located, densely vegetated bosque. The large mesquite and ironwood trees will provide a cool and scenic environment for picnicking. The picnic area will be minimally developed (no pavement or ramadas provided). Picnic sites will be spaced so that the bosque will not be severely impacted and so that picnickers can enjoy the area in as natural a state as possible. This site will have 30 6-person tables, 5 of which will be clustered to form a group area. Parking for 50 cars will be provided. The picnic area costs are shareable.

5. Group and Walk-in Camping.

A group camping area, located above the 50-year flood elevation, is planned upstream from Cave Creek Dam on the east side of and adjacent to Cave Creek. A walk-in campground will also be developed in this area adjacent to the group camping area and on the west side of Cave Creek. Both sites are designed to accommodate 100 persons. 10 picnic tables, 10 trash containers, and a vault toilet will be provided at each of the two camping areas. In addition, the group campground will contain group ramadas, each of which will shade 4 tables, and barbecue grills. One parking area designed to accommodate 40 cars will serve both campgrounds. All facilities will be designed and placed on the site so that impacts to the local environment are minimized. Development of camping facilities is cost shareable.

## 6. Pointer training area.

The pointer group will use the wash area adjacent to the hills on the west side of the basin, upstream from Cave Creek Dam, as a training ground. The pointer group considers the wash area a suitable location because its natural vegetation provides ideal cover from which the pointers can flush birds. Since there is virtually no cholla growth in the wash area and the area is relatively flat, the pointers will be able to run long distances with few obstructions. On the few occasions when the pointer trainers want to use a water course, they can utilize the retriever course. No development apart from the access loop road and signs will be needed for pointer training. Parking spaces at the picnic area and the unturfed multiuse area will serve the pointer dog enthusiasts as well.

## 7. Retriever Training Area

A retriever training area will be located between Cave Buttes Dam and Cave Creek Dam to exploit the varied terrain produced by the borrow pit excavation and the wildlife pond (see below). The water and wetland vegetation will provide a natural obstacle course for the retrievers. The area will be enclosed by two manmade structures (Cave Creek Dam to the north and Cave Buttes Dam to the south), and two natural landforms (mountains to the west and east). The area, which would encompass about 179 acres (72 ha), is ideal in that it is separated from the main recreation area upstream from Cave Creek Dam. Training and trials, however, will always be open to the public. A small parking lot for 20 cars will be provided on the east side of this site.

8. Model airplane flight area.

The borrow area to the north of Dike No. 2 will be reserved in Phase I as a radio-controlled model aircraft take-off and flight area. This site is envisioned as a satellite facility; the major model plane flying area is planned for Reach 11 of the CAP Aqueduct. A local model airplane club is currently using the site with the authorization of the Flood Control District of Maricopa County. Under Phase I development, the present compacted fill runway will be paved, an area will be provided for operating "U"-controlled model airplanes (circular flight pattern), and automobile access and parking for 30 cars will be constructed.

Radio-controlled aircraft flights will be restricted to air space bounded to the north and west by Jomax Road, to the south by Dike No. 2, and to the east by the standard project flood line. The model airplane area development is cost shareable.

9. Sundial and overlook.

The existing overlook facility, which includes the parking area, trails, toilets, interpretive plaques, and the sundial, was built as part of the Cave Buttes Dam flood control project. Operation and maintenance responsibility for the overlook rests with the Flood Control District of Maricopa County (FCDMC), as outlined in the project 221 agreement. When recreation facilities are developed the Flood Control District may arrange for the recreation sponsor to operate and maintain the facility on its behalf.

Since the overlook's completion, it has been damaged by vandals. This problem is attributed to the fact that the structure is in an isolated area and is not visible from any nearby road. At the time that Jomax Road is widened, minimal modification to the overlook to improve its vandal resistant qualities will be undertaken.

The overlook facility will be renovated and upgraded to incorporate it into the recreation area during Phase I development. New interpretive signs will be mounted in the overlook. These will give a brief account of the project's flood control purpose and the basin's natural history; the recreation opportunities in the project area will also be featured. The sundial will be cleaned and the toilet structures opened and expanded. Trail signs will be installed.

The overlook and appurtenant facilities will complement the recreation development in the basin. Visitors will gain comprehensive views of the Cave Buttes basin, its recreation trails and facilities; information on these facilities and on the flood control project in which they are located will be provided there. Phase I development at the overlook will be cost shared between the Federal government and the local cost sharing sponsor for recreation.

#### 10. Trails.

The trail system for hiking and equestrian use will be built in Phase I, with only minimal additions in Phase II. A trail system that winds through dense desert wash vegetation and sandy streambeds will allow equestrians and nature observers to penetrate esthetically pleasing and diverse

environments. These basin trails will connect with existing and proposed trails to the north and south of the project area. Proposed trails will follow the alignments of existing trails, dirt roads, and flood control access roads as much as possible. New trails will be made of compacted fill. Horsemen currently use Apache Wash and Cave Creek as equestrian trails; therefore the washes are included as part of the trail system. Trail improvement in the washes will be very minimal. The beds of both washes consist of cobbles and coarse sand which can be easily negotiated by horses. Compacted fill may be used in some spots, but would be swept away with storm flows. Bicyclists will use the paved loop road and spur roads. Roadways will be wide enough to safely handle both bicycles and motorized vehicles. Trails and paved roadways (including bike lanes) will be cost shareable.

#### E. PHASE I WILDLIFE ENHANCEMENT

The goal of this project is not only to provide for recreational needs of the Phoenix population but also to preserve and improve the environmental resources found in the project area. Cave Creek and Apache Wash provide opportunities to improve the wildlife values of the project area.

##### 1. Wildlife pond.

An area immediately north of Cave Buttes Dam will be recontoured so that a portion of water flowing through the basin from rains will be retained to provide a small, seasonal pool of water. The pool will be unlined to allow water to percolate into the ground. The pond will have a water supply only during wet times of the year. This feature is designed to enhance wildlife and wildlife habitat in the project area. Herbaceous vegetation, which is

expected to flourish during most of the year, will provide forage for many animals. Some riparian plants, such as cattail and willows, may be introduced in this area; the species chosen will be annuals or will be able to withstand occasional inundation in the winter. Collection of debris and silt will not be a problem, as both are expected to settle out of the water after it collects behind Cave Creek Dam. The pond development will be studied in more detail in the Cave Buttes Dam recreation FDM. Costs of the pond development will be charged to wildlife enhancement. The Federal share will be 75 percent; the local share will be 25 percent.

#### F. PHASE II RECREATION DEVELOPMENT

Because of the anticipated growing recreation needs of urban dwellers in the area, the proposed Phase II activities are expected to have greater impact on the land use in the area. Areas planned to handle higher concentrations of visitors will be intensively developed. Other areas will be left in a natural state, permitting less intensive use. The estimated cost for Phase II is \$3,854,400, with an annual operation and maintenance cost of \$117,700.

##### 1. Wildlife/fishing and boating lake.

A small artificial lake is proposed north of Cave Creek Dam. One half of the lake (the east side) will be devoted to water-based recreation. The western half of the lake will be designed for wildlife enhancement (see section G-1 below). The lake will be open to small nonpower boats. Boats will access the lake by way of facilities located on the eastern shore near the proposed park center. The lake size and depth are to be determined after complete engineering, geotechnical, and water availability studies are made.

A study of vector problems and water quality will also be needed. The cost of the lake will be borne entirely by the recreation sponsor.

2. Park center.

The park center will be located adjacent to the boating and fishing half of the wildlife and recreation lake, which is on the east side of the basin. This area will be the most intensively developed portion of the park and will be designed to handle the highest concentration of visitors in the basin. Lakeside facilities - such as a fishing pier, boat docks, bait shop, parking area, and a boat rental concession - will be built in this area. Other facilities might include a visitor center and a snack bar. These kinds of facilities and concessions are not cost shareable and would be designed and constructed at local expense. A tot lot is also planned for the park center. This facility is eligible for cost sharing with the Federal government.

3. Golf course.

An 18-hole golf course will border the lake on the southeast. This course and associated club house are scheduled for development by the project's local sponsor, the Maricopa County Parks and Recreation Department. A small wash runs through the golf course site. The course will be designed so that the esthetic and wildlife values of this wash are retained.

4. Picnic area.

Land adjacent to the wildlife enhancement area along the western shore of the lake will remain secluded for such passive uses as picnicking, strolling, and shore fishing. 40 picnic tables, with ramadas (2 tables per ramada), grills, and trash containers, will be provided. Landscaping to define space and provide shade and coolness is also planned for this area. Parking will be available for about 60 cars. The parking area and picnic facilities will be cost shared.

5. Recreation vehicle campsite.

A recreation vehicle (RV) campground is proposed next to the model airplane flight area, in the borrow area north of Dike No. 2. This campground will help accommodate the many visitors who come to the Phoenix area in RV campers. Paved access to all parking sites will be provided. Utility hookups, shade trees, and two low-maintenance rest rooms will be part of this facility. The facility will be cost shared with the local sponsor. Signs posted at the campground will caution visitors of the potential flood hazard and instruct them how to safely exit the basin. It will be the responsibility of the local recreation sponsor to close the campground when floods are predicted.

Riding and hiking trails and a bicycle path will connect this campground to all parts of the Cave Buttes basin. On occasion, very large numbers of campers will be expected at the Cave Buttes basin to attend special events such as dog trials, hot air balloon meets, or combined training competitions. This area will then serve as an overflow campground and/or parking lot. Motor

vehicles will thus be kept from disturbing other more environmentally sensitive areas.

6. Multiuse paved areas and turfed areas.

Multiuse paved areas and turfed areas are also proposed for Phase II development. The multiuse area to be provided as part of Phase I development (see Chapter 8, Section D) will also be turfed at this time. All multiuse turfed and multiuse paved areas are cost shareable items. Multiuse paved areas will be designed to accommodate volleyball, basketball, shuffleboard and tennis, as well as other games. Outdoor lighting will be provided for night use. Areas used for horseshoes and volleyball will be surfaced with sand rather than paved. Parking plans call for at least two parking lots holding a total of 80 vehicles for the multiuse turfed area, and one lot with a capacity of 70 vehicles for the multiuse paved areas.

7. Archery course.

A target archery range and a field archery course will be located on the eastern slopes of the Union Hills, northwest of Cave Creek Dam. Both ranges would utilize the existing terrain; the field archery course will encompass the varied topography of the hillsides, and the target range will be situated at the foot of the hills (several hundred feet south of the field archery course). For safety reasons, the target archery range will be fenced. The archers have stated that they will design their own field archery course in accordance with their association's specifications. Although there are excellent archery ranges at the nearby Black Canyon Shooting Range, an unmet demand remains for open space field target archery courses of this type.

Archery facilities are not currently cost shareable. Also included will be a 30 vehicle parking area.

8. Flood damage to recreation features.

The increased recreation development proposed in the Phase II plan may require protection from storm flows that occasionally occur along Cave Creek. The urban development that is projected for the area north of the Cave Buttes Dam basin will produce large volumes of runoff, and therefore a higher peak in the Cave Creek storm flow. It is anticipated that the danger of flood damage will be avoided by locating major recreation development (buildings, paved multiuse areas, lake) above the 100-year flood elevation and well out of the Cave Creek and Apache Wash floodways.

## G. PHASE II WILDLIFE ENHANCEMENT

Besides providing space for recreation, the Cave Buttes Dam project area also presents an opportunity to increase and diversify wildlife habitat. Plans that enhance wildlife values are cost shareable; 75 percent is the Federal share and the remaining 25 percent is a local responsibility.

### 1. Wildlife enhancement area.

Cave Creek flows through the project area, entering the flood basin from the northeast and flowing to and around the west side of Cave Creek Dam. No recreation development can feasibly occur in the Cave Creek floodway, which in some areas is over 1300 ft (400 m) wide. Native desert wash vegetation, however, will be planted within the floodway, effectively slowing the storm flows along this reach of Cave Creek; this will provide water and nutrients to the vegetation without washing it away, except in the severest of floods. Plant species incorporated into the wash will be chosen for their ability to provide food and shelter for wildlife as well as their ability to withstand the local desert climate. Plate 7 indicates the original patterns of native vegetation in the basin and where the borrow areas have affected this vegetation.

Visitors to Cave Buttes Dam will be welcome to hike through and enjoy the wildlife enhancement area, which will be a convenient distance from parking areas and recreation activities.

2. Wildlife lake.

Adjoining the wildlife enhancement area will be the western shore of the wildlife/fishing and boating lake. This half of the lake will be devoted to wildlife enhancement. Here, the lake shore will be contoured to accommodate a wide spectrum of riparian plant species that will provide food and cover for wildlife. The only planned development for this area is a shoreline trail. The exact size of the lake cannot be determined at this time. Unknown factors, such as on-site soil stability, must be explored before the lake can realistically be sized. For this master plan, 20 acres (8 ha) was assumed to be a desirable size for the lake. The cost of excavating and developing the lake must, under current policy guidance, be an entirely local expense.

H. CAVE CREEK REGIONAL PARK

Trails for hikers, joggers, bicyclists, and equestrians will thread the entire length of Cave Creek Regional Park. These trails will connect to those planned for the Arizona Canal Diversion Channel, Union Hills Park, Granite Reef Aqueduct, and Cave Buttes Dam. Rest room facilities will be located throughout the park.

The plan for development of the park includes a scenic parkway that will continue north through Union Hills Park to the Central Arizona Project Aqueduct. As an element of the park system, the scenic parkway will be designed specifically for low-speed leisure driving. This is particularly appropriate because driving for pleasure far outranks all other outdoor recreation activities.

Because discharges from Cave Buttes Dam will flow down Cave Creek, flood plain management along the creek as far as the Arizona Canal is a project requirement of the local sponsor. Therefore, participation in the development of project-oriented recreation features along this reach of Cave Creek was considered desirable. The recommendation for flood plain management along this reach will permit local interests to realize their plans for a linear park along the wash. Recreation development along Cave Creek will require redesign of the Cave Creek floodway. The current floodway delineation is based on existing land use.

In the Phoenix Planning Department's Land Use Plan for 1990, Cave Creek Wash from Cave Creek Dam downstream to the Arizona Canal is designated as public open space. The City of Phoenix already has acquired about 450 acres (180 ha) along the wash between Greenway Road and the Arizona Canal for recreational development. Stimulated by proposed recreation development along the Granite Reef Aqueduct east of Cave Creek Road, the city plans to acquire an additional 1400 acres (570 ha) along the wash north of Greenway Road; this will allow Cave Creek Regional Park to extend north to Cave Buttes Dam, thereby joining recreation areas along the aqueduct and the scenic drive and trails that will connect Union Hills Park. The only formal recreation facility along Cave Creek Wash from Cave Buttes Dam to the proposed Arizona Canal Diversion Channel is located at Greenway Road and 19th Avenue. A golf course is currently being developed at this location.

Cave Creek Regional Park will provide recreational facilities not only for residents of adjacent neighborhoods, but for residents of the entire Phoenix area. Because the park will adjoin several residential subdivisions that have

no space reserved for recreation, small parks serving these subdivisions have been planned in selected locations. Other facilities, such as an outdoor education center and a scenic parkway, will attract users from more distant parts of the city. The Federal government will cost share with the local sponsor in recreation development along the channelized portion of Cave Creek Regional Park. This consists of a short reach extending south from Peoria Avenue to the Arizona Canal Diversion Channel. The Federal government has not determined whether other reaches of Cave Creek are eligible for cost sharing.

The recreation development plan for specific areas of Cave Creek Regional Park is detailed in the following subsections.

1. Cave Buttes Dam to Deer Valley Drive.

The land between Cave Buttes Dam and Deer Valley Drive is heavily scarred due to borrow operations during dam construction, as well as by ongoing sand and gravel mining operations. The excavated area will be transformed into lagoons to serve as wildlife habitat. There is a possibility that water for the lagoons could come from the adjacent Central Arizona Project (CAP) Aqueduct. Other possible alternative sources of water include existing wells, discharges from Cave Buttes Dam, and runoff from rainfall.

2. Deer Valley Drive to Beardsley Road.

Picnic sites adjacent to a small lagoon will be developed between Deer Valley Drive and Beardsley Road. This area, with bicycle, hiking, and riding trails extending the full length of the park, will be attractive to visitors and to employees of industries located nearby.

3. Beardsley Road to Bell Road.

A nine-hole, par three golf course, located just south of Beardsley Road and developed by local interests, will also be convenient to the industrial community. A 20-acre (8 ha) park, planned near the corner of Union Hills Drive and 7th Street, will provide recreation facilities for residents of the north Phoenix area. Facilities at the park will include an amphitheater, group and individual picnic sites, a playground, multiuse paved areas, and turfed multiuse areas. The park will also contain a swim complex. A 12-acre (4.8 ha) park is planned adjacent to residential development north of Bell Road. This park will include picnic facilities, a playground, athletic fields, and multiuse paved areas. A lagoon that could be used for model boating will be located nearby.

4. Bell Road to Greenway Road.

Between Bell and Greenway Roads the regional park will be divided by privately owned lands that the City Planning Department has designated as most suitable for residential development. An equestrian center, where riding clubs may meet to begin trail rides, will be located west of the privately owned lands. Riders who do not own horses could rent them at a stable that will be developed by local interests. A nearby orchard development is also planned by local interests. Picnic areas adjacent to lagoons will be placed just south of the orchard development. East of the privately owned lands, a 4-acre playground area is planned. This area will contain play apparatus, multiuse paved areas, and turfed multiuse areas. A picnic and lagoon area will be located nearby.

5. Greenway Road to Thunderbird Road.

The section of Cave Creek Regional Park between Greenway Road and Thunderbird Road will be developed by the local sponsor into an 18-hole municipal golf course with clubhouse facilities, driving range, and putting greens. The 20 acres (8 ha) immediately east of the golf course will be developed into a passive-use area designed to meet the recreation needs of senior residents of the Phoenix area. The park will contain such features as an amphitheater, spacious outdoor patios, group barbecue areas, and tournament-quality shuffleboard and horseshoe courts.

6. Thunderbird Road to Cactus Road.

When fully developed, the subdivision bordered by Black Canyon Highway, Thunderbird Road, Cactus Road, and 19th Avenue will house about 7,500 persons. The plan for the portion of Cave Creek Regional Park that will pass through this section proposes development of a 13 acre (5.3 ha) park and a 4 acre (1.6 ha) park. Another area of about 4 acres is planned for local picnicking and similar activities. All of these facilities will serve recreationists from adjacent neighborhoods, as well as those from other areas of the city. In addition to the previously mentioned parks, a center of community scale for passive recreation activities is proposed near the center of this section. The center will include a band shell for music concerts; a covered pavilion for outdoor dancing, organized games, dog shows, and a variety of similar activities; and facilities for large organized picnics and outdoor assemblies. Lagoons flanking Cave Creek in this area will support fish, waterfowl, and aquatic plants. They will afford opportunities for model boating, fly and bait casting, and fishing contests.

7. Cactus Road to Peoria Avenue.

A 12-acre (5 ha) park is planned in the northern portion of the section between Cactus Road and Peoria Avenue. This park will contain facilities for picnicking, field sports, and court games. Also located in this section, where conflict with other park activities is minimal, will be a complete archery center, including a standard 28-target field archery course, practice ranges, and clubhouse. Constructed to standards established by national archery associations, the center will provide central facilities for use by archery clubs, park department classes and competitions, and individuals.

8. Peoria Avenue to Arizona Canal Diversion Channel.

The City of Phoenix has developed a greenhouse complex just south of Peoria Avenue. Other activity areas planned in this section of the park will be developed with Federal participation. These areas will include turfled multiuse areas and a recreation area with picnic sites and multiuse paved areas. A nature study center is planned in the regional park, near the headquarters of the Arizona Game and Fish Department. This center will afford children and adults the opportunity to see, feel, and hear about Arizona's natural resources, as well as to learn about the conservation and use of these resources. Outdoor facilities will include areas for live exhibits of insects, amphibians, reptiles, small mammals, and desert plants. An indoor facility will house scientific exhibits and will serve as a meeting place where a wide variety of nature-oriented illustrated talks and lectures could be held. The outdoor facilities are cost shareable, while the indoor facility is a local expense. Local sponsors will construct a library facility, with reading rooms and workshops. A maintenance yard serving all of the regional

park areas will be located adjacent to 23rd Avenue, east of the proposed Cave Creek channel.

9. Sources of Irrigation Water.

Wells near Thunderbird Road and Peoria Avenue will be used to irrigate the southern part of Cave Creek Regional Park (south of Greenway Road) and to fill and maintain a lagoon. The City of Phoenix Parks and Recreation Department is currently using water from the Peoria Avenue well to irrigate a nursery and greenhouse development. Water from the Central Arizona Project (CAP) Aqueduct may be the water source for lagoons in the northern part of Cave Creek Park. Other potential sources are ground water, rainfall, and runoff from Cave Buttes Dam.

10. Construction Schedule.

The portion of the regional park south of Peoria Ave (cost shareable) is scheduled for development in 1988. The remainder of Cave Creek Regional Park will be constructed in segments, as funds become available. Approximately 12 acres (5 ha) in the southern part of the park, from Greenway Road to the Arizona Canal, have recently been donated to the local sponsor. Additional donations of 30-acre (12 ha) and 20-acre (8 ha) parcels in the southern part of the park are anticipated in the near future.

I. SCHEDULE OF DEVELOPMENT

The Maricopa County Parks and Recreation Department and the Corps of Engineers have discussed the schedule for Phase I and Phase II recreation development at Cave Buttes Dam; the City of Phoenix Parks and Recreation

Department and the Corps have discussed the schedule for recreation development along the Cave Creek Wash area of the proposed Cave Creek Regional Park. The proposed completion dates for recreation construction for each phase of the program are listed below:

	<u>Start Date</u>	<u>Completion Date</u>
Cave Buttes Dam:		
Phase I	1985	1986
Phase II	To be determined	
Cave Creek Regional Park:		
From Peoria Avenue South to the ACDC		To be determined
From Cave Buttes Dam South to Peoria Avenue		

#### J. COST ESTIMATES

The cost estimates presented in this master plan include construction of recreation facilities and wildlife enhancement features, as well as costs for engineering and design, and supervision and administration. The recreation costs of most facilities will be shared equally by the Federal government and the local sponsor. The cost of certain recreation facilities must be borne entirely by the local sponsor. Other costs allocated to wildlife enhancement will be cost shared, with the Federal government paying 75 percent and local interests paying 25 percent. Operation and Maintenance costs (\$74,900 annually for Phase I and \$117,700 annually for Phase II) will be a local responsibility. Costs and cost sharing responsibilities are summarized in Tables 9 and 10. Tables 6, 7 and 8 give more detailed cost breakdowns. All estimates are based on January 1982 prices.

Corps involvement with Cave Creek Regional Park from Cave Buttes Dam to Peoria Avenue will require a policy decision permitting cost sharing in recreation that is associated with nonstructural flood control projects. If and when the Corps is given the authorization to cost share in nonstructural flood control projects and a letter of intent from a local sponsor is received, detailed plans for Cave Creek Regional Park will be prepared and presented in a feature design memorandum.

Detailed cost estimates for Cave Creek Regional Park are given only for the portion from Peoria Avenue to the Arizona Canal Diversion Channel (Table 8), as this is the only portion presently eligible for cost shared recreation development. Lump sum items are given for the other reaches of the park (Table 10). The lump sum figures shown include contingencies, supervision and administration (S&A), and engineering and design (E&D) costs.

#### K. DISCUSSION OF COST INCREASES

There has been a considerable increase in the estimated cost of the project as compared to the estimate presented in the March 1976 General Design Memorandum. This increase is due primarily to an expanded recreation development plan. The Phase I plan presented in this master plan includes all the recreation provisions of the original plan, plus a combined training-endurance trial area, an equestrian center, an unpaved multiuse area, a primitive camping area, a wildlife pond, and a space for model airplane flying. Phase II provides for further additions to the plans for both recreation development and wildlife enhancement which also increases costs.

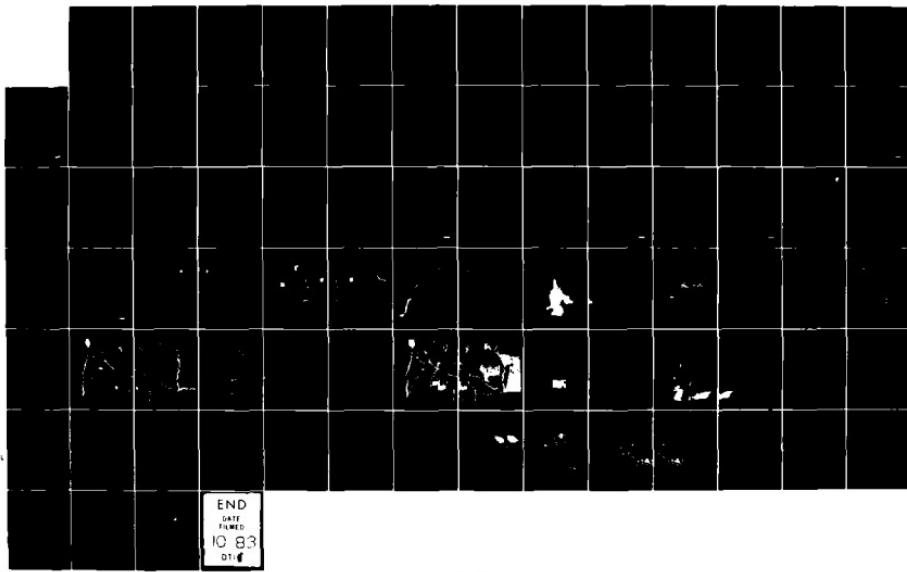
AD-A133 055 CAVE BUTTES DAM MASTER PLAN PHOENIX ARIZONA AND  
VICINITY (INCLUDING NEW RIVER)(U) ARMY ENGINEER  
DISTRICT LOS ANGELES CALIF MAR 82

2/2

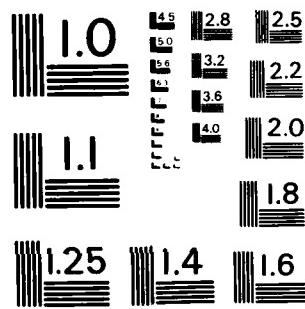
UNCLASSIFIED

F/G 13/2

NL



END  
NOT  
PAGED  
IC: 83  
DTI



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS - 1963 - A

The differences in costs that appear when cost tables in this document are compared to those in the Overall Master Plan, DM #4, are attributable to price increases due to inflation and to the addition of lighting for the multiuse paved areas. Cost estimates in the Overall Master Plan are based on July 1980 price levels, while this final version of the Cave Buttes Master Plan, DM #6, employs January 1982 figures. Costs of the past and present proposals for Cave Buttes recreation development are summarized below.

<u>Phase</u>	<u>DM #3</u>	<u>PB-3 1 October, 1981</u>	<u>DM #4</u>	<u>Master Plan March 1982</u>
Phase I	-	-	\$1,166,400	\$1,279,300
Phase II	-	-	\$3,542,100	3,854,400
Total Dev.	\$540,000	\$1,313,000	\$4,708,500	\$5,133,700

Note: Figures are first costs, and include 15 percent contingency, 15 percent E&D, 6 percent S&A.

As shown in Table 2, all newly planned recreation development will help satisfy unmet demand in the Maricopa County market area. In some cases, the Phase I plan will provide recreation opportunities that are either currently unavailable in the market area, or are provided to a very limited degree. The equestrian combined training facility, for instance, will be the only one of its kind in Maricopa County, if not the entire Southwest. Phase II additions are economically feasible at this time; the benefits of this plan may increase as the metropolitan area spreads to the vicinity of Cave Buttes Dam. The addition of the Phase II plan is justified, as it will help reduce the future unmet demand for recreation that will be generated by this anticipated influx of new local residents.

Table 6. Cost Estimate - Phase I (January 1982 Costs)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
1	Group ramadas (concrete roof and columns)	5	ea	22,630.00	113,200
2	Individual ramadas (concrete roof and columns)	4	ea	7,700.00	30,800
3	Steel BBQ grills	10	ea	170.00	1,700
4	Concrete picnic tables	35	ea	790.00	27,700
5	Concrete camping tables	20	ea	790.00	15,800
6	Concrete trash containers	55	ea	390.00	21,500
7	Rest room (vault toilets)	5	ea	11,900.00	59,500
8	Directional signs	15	ea	125.00	1,900
9	Parking areas (paved)	7,560	ft <sup>2</sup>	1.21	9,100
10	Parking areas (decomposed granite)	13,600	ft <sup>2</sup>	.26	3,500
11	Access roads (paved)	31,635	ft	5.60	177,200
12	Site clearing & grubbing	20	ac	522.00	10,400
13	Riding and hiking trails	10	mi	10,140.00	101,400
14	Hitching posts	10	ea	680.00	6,800
15	Grading	3	ac	1,960.00	5,900
16	Wildlife pond excavation	130,000	yd <sup>3</sup>	2.22	288,600
17	Wildlife pond shore planting- 5 gallon trees	1,000	ea	24.00	24,000
18	Trees - 5 gallon	300	ea	24.00	7,200
19	Interpretive signs (at overlook)	5	ea	2,400.00	12,000

Table 6. Cost Estimate - Phase I (Continued)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
20	Trail signs	5	ea	100.00	500
21	Restroom rehabilitation (overlook)	1	Job	700.00	700
	Subtotal:				919,400
	Contingencies (15%)				<u>137,900</u>
	Subtotal				1,057,300
	Engineering & Design* (15%)				158,600
	Supervision & Administration (6%)				<u>63,400</u>
	Total:				1,279,300

\*In the Overall Master Plan (Table A-9) the following costs were assigned to engineering and design work on the Phase I recreation development plan for the purpose of computing benefit cost ratios:

Phase I GDM	\$36,625
Overall Master Plan	\$19,250
Cave Buttes Dam Master Plan	\$17,250
Total	<u>\$73,125</u>

Table 7. Cost Estimate - Phase II (January 1982 Costs)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
1	Individual ramadas (concrete roof and column)	22	ea	7,700.00	169,400
2	Steel BBQ grills	30	ea	170.00	5,100
3	Concrete picnic tables	42	ea	790.00	33,200
4	Concrete trash containers	32	ea	390.00	12,500
5	Rest rooms (vault toilets)	2	ea	11,900.00	23,800
6	Directional Signs	50	ea	125.00	6,300
7	Parking areas (paved)	40,450	ft <sup>2</sup>	1.21	48,900
8	Access road	3,750	ft	5.60	21,000
9	Site clearing and grubbing	40	ac	522.00	20,900
10	Grading	40	ac	1,960.00	78,400
11	Fencing (chain link)	900	ft	8.00	7,200
12	Turfed multiuse areas	1	Job	12,100.00	12,100
13	Paved multiuse areas	1	Job	257,500.00	257,500
14	Outdoor lighting (for multiuse paved areas)	1	Job	263,500.00	263,500
15	Recreation vehicle camp	1	Job	22,900.00	22,900
16	Tot lot	1	Job	13,000.00	13,000
17	Turf (irrigated)	35	ac	18,300.00	640,500
18	Trees 5 gallon	200	ea	24.00	4,800
19	Trees - 15 gallon	200	ea	98.00	19,600

Table 7. Cost Estimate - Phase II (Continued)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
20	Hose bibbs	20	ea	25.70	500
21	Lake excavation	322,666	yd <sup>3</sup>	2.22	716,300
22	Lake sealing	20	ac	13,130.00	262,600
23	Bank protection	23,000	ft <sup>2</sup>	2.77	63,700
24	Water well (for lake)	1	Job	63,400.00	63,400
	Subtotal:			2,767,100	
	Contingencies (15%:)			415,100	
	Subtotal			3,182,200	
	Engineering and design (15%)*			477,300	
	Supervision and administration (6%)			190,900	
	Total:			3,854,400	

\*In the Overall Master Plan (Table A-9) the following costs were assigned to engineering and design work on the Phase II recreation development plan for the purpose of computing benefit cost ratios.

Phase I GDM	\$106,875
Overall Master Plan	57,750
Cave Buttes Dam	51,750
Master Plan	
Total	\$216,375

Table 8. Cost Estimate - Cave Creek Regional Park from Peoria Avenue to the ACDC (January 1982 Costs)

<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total</u>
<b>Recreation area:</b>				
Landscaping	3	ac	19,500.00	58,500
Administration building*	2,000	ft <sup>2</sup>	91.20	182,400
Restroom	1	ea	81,200.00	81,200
Multipurpose paved areas	1	job	195,000.00	195,000
Walkways	1,800	ft <sup>2</sup>	1.94	3,500
Benches	25	ea	391.00	9,800
Trash containers	10	ea	390.00	3,900
Parking area	22,300	ft <sup>2</sup>	1.21	27,000
Lighting poles	8	ea	3,260.00	<u>26,100</u>
			<u>Subtotal</u>	<u>587,400</u>
<b>Picnic and play area:</b>				
Landscaping	10	ac	19,500.00	195,000
Picnic sites (2 tables + ramada)	25	ea	14,700.00	367,500
Playground	1	job	41,700.00	41,700
Athletic fields	2	ea	32,600.00	65,200
Walkways	2,100	ft <sup>2</sup>	1.94	4,100
Benches	10	ea	391.00	3,900
Trash containers	10	ea	390.00	3,900
Restroom	1	ea	81,200.00	81,200
Day Camp Area	1	job	8,000.00	<u>8,000</u>
			<u>Subtotal</u>	<u>770,500</u>
<b>Nature study center</b>				
Outdoor display area	1	job	16,300.00	16,300
Exhibit building*	1	job	312,700.00	<u>312,700</u>
			<u>Subtotal</u>	<u>329,000</u>
Scenic drive	1	job	127,100.00	127,100
Park maintenance yard*	1	job	133,500.00	133,500
			<u>Subtotal</u>	<u>1,947,500</u>
			Contingencies (15%)	292,100
			<u>Subtotal</u>	<u>2,239,600</u>
			Engineering and design** (15%)	335,900
			Supervision and administration (6%)	<u>134,400</u>
			<u>Total</u>	<u>2,709,900</u>

\* Facility is not cost shareable

\*\*In the Overall Master Plan, costs for the reach of Cave Creek from Peoria Avenue to the ACDC were totaled as part of the ACDC costs. They represent 23.42% of the total ACDC first costs for recreation. Based on this, and the figures for engineering and design given in Table A-9 of the Overall Master Plan, the following costs for engineering and design are assigned to the reach of Cave Creek from Peoria Avenue to the ACDC:

Phase I GDM	33,400
Overall Master Plan	18,000
Master Plan	<u>0</u>
	51,400

Table 9. Costs Summary - Cave Buttes Dam

Recreation Area (January 1982 costs)

Facility	Initial Quantity	Initial Costs		Cost Shared	Future Quantity	Future Costs		S
		100% Federal	100% Local			100% Federal	100% Local	
Group ramadas	5 ea			113,200	-			
Individual ramadas	4 ea			30,800	22 ea			16
Steel BBQ grills	10 ea			1,700	30 ea			
Concrete picnic/ camping tables	55 ea			43,500	42 ea			3
Concrete trash containers	55 ea			21,500	32 ea			1
Restrooms (vault toilets)	5 ea			59,500	2 ea			2
Directional signs	15 ea			1,900	50 ea			
Parking areas (paved)	7,560 ft <sup>2</sup>			9,100	40,450 ft <sup>2</sup>			4
Parking areas (decomposed granite)	13,600 ft <sup>2</sup>			3,500	-			
Access roads (paved)	31,635 ft			177,200	3,750 ft			2
Site clearing & grubbing	20 ac			10,400	40 ac			2
Riding and hiking trails	10 mi			101,400	-			
Hitching posts	10 ea			6,800	-			
Grading	3 ac			5,900	40 ac			7
Wildlife pond* (excavation and planting)	1 Job			312,600	-			
Tree planting	300 5 gal			7,200	200 5 gal 200 15 gal			2

**Table 9. Costs Summary - Cave Buttes Dam**

**Recreation Area (January 1982 costs)**

100% Local	Cost Shared	Future Quantity	Future Costs		Cost Shared	Total Quantity	Total Costs		Cost Shared
			100% Federal	100% Local			100% Federal	100% Local	
113,200	-				-	5 ea			113,200
30,800	22 ea				169,400	26 ea			200,200
1,700	30 ea				5,100	40 ea			6,800
43,500	42 ea				33,200	97 ea			76,700
21,500	32 ea				12,500	87 ea			34,000
59,500	2 ea				23,800	7 ea			83,300
1,900	50 ea				6,300	65 ea			8,200
9,100	40,450 ft <sup>2</sup>				48,900	48,010 ft <sup>2</sup>			58,000
3,500	-				-	13,600 ft <sup>2</sup>			3,500
177,200	3,750 ft				21,000	35,385 ft			198,200
10,400	40 ac				20,900	60 ac			31,300
101,400	-				-	10 mi			101,400
6,800	-				-	10 ea			6,800
5,900	40 ac				78,400	43 ac			84,300
312,600	-				-	1 Job			312,600
7,200	200 5 gal 200 15 gal				24,400	500 5 gal 200 15 gal			31,600

Table 9 (Continued)

Facility	Initial Quantity	Initial Costs		Cost Shared	Future Quantity	Future Costs		Cos Shar
		100% Federal	100% Local			100% Federal	100% Local	
Overlook rehabilitation (signs and restroom)	1 Job			13,200	-			
Turfed multiuse areas	-			-	1 Job			1
Fencing (chain links)	-			-	900 ft			
Paved multiuse areas	-			-	1 Job			25
Outdoor lighting (for paved multiuse areas)	-			-	1 Job			26
Recreation vehicle camp	-			-	1 Job			27
Tot lot	-			-	1 Job			1
Irrigated turf	-			-	35 ac			64
Hose bibbs	-			-	20 ea			
Lake (excavation, sealing, bank protection, well)	-			-	1 Job		1,106,000	
<b>Totals</b>				919,400 <sup>1</sup>			1,106,000	1,66

\* 75% Federal cost, 25% local cost (Wildlife enhancement)

1. Contingencies (137,900), Engineering and Design (158,600) and Supervision and Administration (63,1,279,300).
2. Contingencies (249,200), Engineering and Design (286,000) and Supervision and Administration (114 Phase II up to 2,311,500.

Table 9 (Continued)

00% Local	Cost Shared	Future Quantity	Future Costs			Total Quantity	Total Costs			Cost Shared
			100% Federal	100% Local	Cost Shared		100% Federal	100% Local		
	13,200	-			-	1 Job				13,200
	-	1 Job			12,100	1 Job				12,100
	-	900 ft			7,200	900 ft				7,200
	-	1 Job			257,500	1 Job				257,500
	-	1 Job			263,500	1 Job				263,500
	-	1 Job			22,900	1 Job				22,900
	-	1 Job			13,000	1 Job				13,000
	-	35 ac			640,500	35 ac				640,500
	-	20 ea			500	20 ea				500
	-	1 Job			1,106,000	1 Job				1,106,000
	919,400 <sup>1</sup>				1,106,000	1,661,100				1,106,000 2,580,500 <sup>2</sup>

(enhancement) Design (158,600) and Supervision and Administration (63,400) bring the cost of Phase I development up to Design (286,000) and Supervision and Administration (114,600) bring the total cost-shareable portion of

Table 10. Cost Summary-Cave Creek Regional Park

Facility	Initial Quantity	Initial Cost		Cost Shared	Future Quantity	100% Federal	100% Local	Future Cost	
		100% Federal	100% Local					Cost Shared	
All recreational development south of Cave Buttes Dam to Greenway Road	-	-	-	-	1 Job	-	7,918,300	-	-
All recreational development south of Greenway Road to Peoria Ave.	-	-	-	-	1 Job	-	2,067,600	-	-
Peoria Ave. south to the ACDC									
Park maintenance yard	1 Job	-	133,500	-	-	-	-	-	-
Recreation area	1 Job	-	182,400	405,000	-	-	-	-	-
Picnicking area	1 Job	-	-	770,500	-	-	-	-	-
Scenic drive & trails	1 Job	-	-	127,100	-	-	-	-	-
Nature study center	1 Job	-	312,700	16,300	-	-	-	-	-
Total		628,600	1,318,900*				9,985,900		

\*Contingencies, (197,800), engineering and design (227,500), and supervision and administration (91,000) facilities to 1,835,200.

Table 10. Cost Summary-Cave Creek Regional Park

Cost 100% Local	Cost Shared	Future Quantity	100% Federal	100% Local	Future Cost		Total Quantity	Total Cost		Cost Shared
					Cost Shared	Total Cost		100% Federal	100% Local	
-	-	1 Job	-	7,918,300	-	7,918,300	1 Job	-	7,918,300	-
-	-	1 Job	-	2,067,600	-	2,067,600	1 Job	-	2,067,600	-
3,500	-	-	-	-	-	133,500	1 Job	-	133,500	-
2,400	405,000	-	-	-	-	182,400	1 Job	-	405,000	405,000
-	770,500	-	-	-	-	770,500	1 Job	-	-	770,500
-	127,100	-	-	-	-	127,100	1 Job	-	-	127,100
2,700	16,300	-	-	-	-	312,700	1 Job	-	16,300	16,300
8,600	1,318,900*			9,985,900		10,614,500			1,318,900*	

esign (227,500), and supervision and administration (91,000) bring the total cost of cost shareable

# **Design Criteria**

## Chapter 9

### FACILITY LOAD AND OTHER DESIGN CRITERIA

#### A. GENERAL

The planning and design of recreation features will be guided in part by the uniform design guidelines in Chapter 11 of the Phoenix, Arizona and Vicinity (including New River) Overall Master Plan, Design Memorandum No. 4. These uniform design guidelines, as well as other constraints, must be considered when siting and designing individual recreation facilities. This section provides a discussion of applicable guidelines and criteria for the selection and sizing of facilities that are planned for the project area.

#### B. SITING

The proposed development areas within the Cave Buttes Dam site were selected after the recreation potential of the project was considered as a whole. Factors such as the project's location, flood control requirements, visitor safety, and flood elevations were evaluated. All development will be located on project lands. Placement of the activities was based on a thorough analysis of the physical characteristics of each site and user preference. Slope steepness was also an important factor in siting of activities. The type of facility that can be developed on a slope depends upon the gradient of that slope (Ref. "Site Planning" by Kevin Lynch). The constraints on development that have been established for each range of gradients are as follows:

<u>Percentage</u>	<u>Constraints</u>
0 - 5	Virtually flat, no building restrictions, intense activity
5 - 10	Easy grades, informal movement and activity
10 - 20	Steep, effort needed to move on, play and activity still possible; construction difficult--drainage and erosion problems
Over 20	Construction infeasible; severe erosion problems likely

Slope gradients in the project area are mapped (pl. 13). Other considerations for recreation site and area developments for the Cave Buttes basin are in conformance with ER 1110-2-400, Design of Recreation Sites, Areas, and Facilities.

#### C. WATER SUPPLY SYSTEM

A complete engineering study of available water sources will be made. An estimate will then be developed of the initial and possible future uses to which water may be put before selecting the type of system that would be installed. Groundwater is a potential source, as existing wells in the area provided potable water for homes.

#### D. WASTE TREATMENT SYSTEM

The type and extent of sanitary waste disposal and/or treatment will be determined after a thorough investigation of the specific site. This investigation will be coordinated with health officials of Maricopa County. For the present, use of vault toilets is proposed.

## E. ROADS

Access and circulation roads within the basin will be constructed in accordance with ER 1110-2-400 as well as with requirements submitted by the Maricopa County Highway Dept. Within the Cave Buttes/Cave Creek recreation sites and areas, no road or other circulation system was designed simply as a connecting device to link points of interest. Every segment of every recreation road is related in a meaningful way to the environment through which it passes and, to the extent possible, constitutes an enjoyable and informative experience in itself. The following subparagraphs outline specific elements considered in designing the roads.

### 1. Alignment.

Roads were located so that maximum emphasis was given to interpretive and scenic values. Long straight stretches of roadway, which encourage high speeds and result in viewing blurred scenery, were avoided. Roads, trails, walks, and overlooks within the Cave Buttes site were planned to induce visitors to leave their automobiles and more thoroughly experience the surrounding environment. The siting of access and circulation roads was based on a consideration of the most meaningful way in which visitors could experience the resource, as well as on the need to provide them with connecting routes that link points of interest. In designing the hiking and riding trails, monotony is relieved and maximum advantage of park values is achieved by varying elevations and developing viewpoints and overlooks, as well as by providing close-range views of nearby scenes.

In future design stages, roads and trails will be laid out to complement existing land surfaces as much as possible. Cut and fill for the roadways will be held to a minimum.

2. Pavement Widths.

Pavement widths for two-way access and circulation roads within the Cave Buttes recreation area should not exceed 24 ft (7.3 m), with maximum shoulder widths of 4 ft (1.2 m). Roadway widths in excess of the foregoing require special approval by the Chief of Engineers.

3. Drainage Structures.

Drainage structures and associated facilities will be provided at selected locations so that excess local runoff will be diverted to a concentrated point before being carried across the road. Sizing of each drainage structure will be determined on the basis of a 50-year frequency storm.

F. CIRCULATION

Jomax Road will serve as the access road to the Cave Buttes Dam recreation area. Jomax extends from Cave Creek Road west to the overlook; its alignment is parallel to Dike No. 2 (pl. 17). One two-way traffic loop is proposed off of Jomax Road to ease supervision of people entering and leaving the recreation area. This will also facilitate maintenance of the area by restricting vehicle movement to one access road and providing the most direct route to activities, thereby discouraging off-road "short-cutting". Jomax Road will be widened, at flood control project cost, to safely accommodate public use. The road will have a paved width of 22 ft (6.7 m) with 4 foot (1.2 m) wide gravel shoulders on each side.

The loop road will be laid out during Phase I construction so that it will fit into the Phase II recreation plan with no changes in alignment (pl. 14 and 17). The road will fork about 1-1/2 mi (2.4 km) from the Cave Creek Road entrance; the main road will then continue westward to the overlook structure and a second road will branch off to provide access to the retriever training area between Cave Buttes Dam and Cave Creek Dam. A third road will fork from Jomax Road and lead to the activities in the northern portion of the basin. This road will turn west adjacent to the primitive "walk-in" campsite and then south, returning to connect with the main entry road about 1/2 mi (.8 km) from the overlook parking lot. This road system will provide a complete two-way loop in the upstream basin. It was determined that a two-way traffic loop road system will be most effective in preventing traffic tie-ups and confusion during evacuation of the area in times of flood. By following the two-way traffic loop pattern, the motorist will automatically reach the entry road. Two separate exit points along the entry road should reduce the traffic bottleneck. Roads built by the Flood Control District to access flood control features will be open for public use, but motorized vehicles will be prohibited. The Flood Control District will operate and maintain these roads.

#### G. ARCHITECTURAL CHARACTER

The architectural style of the planned recreation facilities will enhance the character of the existing natural environment. Basic construction materials will include, but are not limited to, concrete, decorative stone, wood, and metal. Structures will be designed to be pleasing, functional, vandal resistant, and low maintenance. The color and design of facilities

will blend with and complement the hues and textures of the surrounding landscape.

#### H. PARKING AREAS

Parking areas within the project site will conform to the directives of ER 1110-2-400. Other requirements provide for as much reduction in the size of parking areas as possible without interfering with effective operation. Parking areas were designed so that vehicles need not back onto access roadways that lead to extensive developments or additional activity areas. Typical sections, curbing and surface treatment, storm drainage, and provision for future expansion will be provided in the feature design memorandum.

#### I. LAKE DEVELOPMENT

The wildlife/fishing and boating lake will be easily seen from surrounding recreation areas in the upstream basin. The eastern shore of the lake is planned to provide fishing and access for small nonpower boats. Only a limited amount of fishing will take place on the western shore, which doubles as a wildlife enhancement area. The lake will be from 20 to 30 acres (8 to 12 ha) in size and will be of a depth sufficient to promote fish growth and minimize the buildup of algae. The lake will be planted with hydrophytic species to provide shade and spawning areas for fish, and to reduce light infiltration. The bottom of the lake will be sealed with either bentonite clay or a plastic liner.

A launching ramp will be provided on the eastern shore of the lake. The ramp will be constructed of poured concrete, with a maximum grade not to exceed 14 percent and a one-lane width of 14 ft (4.3 m). No courtesy docks will be provided.

#### J. PICNIC AREAS

The picnic areas will consist of precast concrete tables 10 ft (3 m) in length. Concrete trash receptacles will be supplied and anchored for each pair of tables. The picnic tables will be located under large mesquite trees. Areas without sufficient natural shade will have concrete ramadas with a natural base flooring. The tables will be located below the 50-year flood level, and, therefore, will be anchored. The paved parking lot at each picnic site will be within 500 ft (150 m) of the picnic facilities. A rest room (possibly a vault toilet system) will be located near the picnic area; the size of the rest room will be determined in accordance with the area's requirements based on expected use. The rest room will be located above the 100-year flood level. A table and trash receptacle will also be located at each of the following sites: multiuse area, equestrian center, retriever training site, and model airplane flight area (Phase I); two tables will be located at the field and target archery sites (Phase II).

#### K. CAMPING AREAS

Three separate camping areas will be developed: a group camp area, a primitive camp or "walk-in" area (Phase I), and a recreation vehicle area (Phase II). Both the group and the primitive camping areas will contain several concrete picnic tables, with a trash receptacle for every table. The group campground will also have steel grills. One steel grill will be provided for every two tables. Each campground will have a vault toilet, and a 5-ft (1.5 m) diameter metal fire ring. Parking will be provided near the group camping area. Only tent campers will be allowed in this area. Visitors must hike into the primitive campground to set up camp.

The recreation vehicle camping area will be designed for trailers and other camping vehicles, but tent campers will be allowed to use the vehicular campsite area. This facility will be especially valuable at times of organized meets and trials. Participants will be able to camp here, at a convenient distance from other activity areas within the basin. Two centrally located restroom facilities will be placed in the area.

#### L. OVERLOOK STRUCTURE

The overlook structure and related facilities were built as part of the flood control project and therefore were Federally funded items. The location selected for the overlook structure offers an excellent view of the reservoir. The structure is located below the top of the hill to blend with its surroundings. It has a concrete floor and concrete block columns faced with native stone mortared in place.

The parking area for the overlook structure was located at the base of the hill to minimize the adverse effects of grading. Two footpaths link the parking lot and overlook structure. One footpath, designed for the handicapped, follows the contours on a 4 percent slope; level landing areas are spaced about 25 ft (7.6 m) apart. The other footpath provides a more direct route, with a slope of 12 to 15 percent. A short path with a maximum slope of 25 percent connects the overlook structure and the viewpoint slab at the top of the hill. Because of the short distance and steep gradient between the overlook structure and the viewpoint, there is insufficient space for a path of less than 8 percent grade for use by the handicapped.

#### M. REST ROOMS

Rest rooms will be located above the 100-year flood elevation and will comply with the sanitation criteria set forth in EM 1110-2-400 and by local governing jurisdictions. Requirements for accessibility by the handicapped also will be followed. Where feasible, rest rooms will be located in close proximity to activity areas. Construction materials will be selected based on their long life, ease of maintenance, and resistance to vandalism. Current plans call for vault toilets. Architectural style for all rest rooms will be modeled after the existing overlook structure and associated rest room.

#### N. UTILITIES

Because of the rural setting of the project, utilities needed usually will require the construction of lines into the basin. All such work and utility alignments will comply with city and county standards. The Phoenix Water and Sewers Department is the utility responsible for water supply in this area. Gas and electricity are the responsibility of the Arizona Public Service Corporation.

#### O. HIKING AND EQUESTRIAN TRAILS

As much as possible, the trail system throughout the project area will follow existing roads and trails, including maintenance roads for flood control features. The system will link the recreation facilities in the area in a meandering manner, following natural contours. A typical section of the trail will maintain a balance between cut and fill requirements. Trails will be graded, but not paved. Trails will conform to standards developed by the Maricopa County Hiking and Riding Trails Committee.

#### P. LANDSCAPE PLANTING CRITERIA

Plants, especially shade trees, will be planted and cultivated in the project area. The major purpose of introducing plants is to enhance the experiences enjoyed by visitors, in terms of the visual quality of the recreation areas and of physical comfort. Plantings are also intended to provide food and cover for wildlife, especially in the areas identified for wildlife enhancement. Landscape plantings will serve a variety of functions. Plant groupings will help identify and define use areas and will improve the visual quality of structures and spaces, especially the borrow areas and dikes. Trees with overhead canopies will be planted in all areas to provide shade and a cooling effect on hot days. Trees will be especially beneficial at concentrated use areas, such as the camping areas, multiuse areas (turfed and unturfed), equestrian center, and intersections of the riding and hiking trails. Trees and large shrubs will improve the spatial quality of the project area. Large open spaces, especially the borrow area north of Cave Creek Dam, will be more pleasant spaces in which to pursue recreation activities when they are broken up and diversified through the planting of trees.

The Phase I plant palette will consist of trees and other vegetation that are native or adaptable to the Phoenix area. All plants will be species that require little or no maintenance and will withstand local climatic extremes. Newly installed seedlings and shrubs may require an establishment period during which time plants would be irrigated and, if necessary, replaced with more healthy stock. The possibility of using drip irrigation as a means of watering trees will be explored in the feature design memorandum.

Existing cottonwood trees just north of Cave Creek Dam indicate that groundwater may be available in certain localities; shade trees would be desirable in such places. The possibility of planting cottonwoods or other riparian trees in these areas will be explored during the design stage of this project. Any vegetation planted in the lower elevations of the flood basin near the dikes and main embankment should be species that can withstand occasional inundation.

Plant materials and landscaping for Phase II will reflect the increase in user density expected at this time. More intensive landscape development, such as paved walkways, turf, and other irrigated plantings, will be installed to more effectively handle increased use. Natural desert terrace and wash areas, however, will still be available for low-density recreation pursuits in Phase II.

#### Q. SIGNS

Eight basic types of signs will guide and direct visitors throughout the project area. Identification, information, direction, regulation, instruction, interpretation, location, and safety messages will be conveyed through a uniform system. (Information and guidance signs will conform to the National Park Service uniform sign system.) The material, scale, and design of the signs will depend on the use and the expressed needs of the local recreation sponsor. Symbols will be used for uniformity and ease of recognition, while word signs will provide interpretive or other information, where needed. The primary emphasis will be on clarity. An identification sign will be placed at the recreation area entrance on Cave Creek Road. Regulatory signs will restrict unauthorized vehicle use on-site.

Instructional and safety signs will caution visitors of the potential flood hazards. Locational signs at strategic points will designate use areas. All signs will be constructed of vandal resistant material and will be positioned for high visibility. Signs will be compatible with the esthetic character of the park.

#### R. MULTIUSE TURFED AREAS AND MULTIUSE PAVED AREAS

Multiuse paved areas will be located adjacent to the east end of the lake within walking distance of the picnic area. These areas will be constructed of three different surface materials: asphalt with an applied acrylic topping, concrete slabs of college court size, 50 by 94 ft (15.2 by 28.6 m), and sand flooring with concrete curbs to retain the sand and facilitate mowing and trimming. Outdoor lighting will be provided for night use.

In the Phase II plan, three turfed multiuse areas will be installed at different locations in the project area.

## **Special Problems**

## Chapter 10

### SPECIAL PROBLEMS

Certain aspects of the recreation development proposed in the Cave Buttes Dam Master Plan warrant particular attention; these are discussed in the following paragraphs.

#### A. MINE SHAFTS AND TUNNELS

The Cave Buttes area contains several abandoned mine shafts and tunnels, indicating earlier attempts to mine localized deposits of gold, silver, copper, lead, and slate. Most shafts have been filled in; any remaining shafts that pose a safety problem will be either filled in or fenced off.

#### B. LAKE WATER SOURCE

A small 20 to 30 ac (8 to 12 ha) boating and fishing/wildlife lake is proposed upstream from Cave Creek Dam. 200 acre-feet of water would be required to initially fill the lake, and an additional 150 acre-feet per year would be needed to replace water lost due to evaporation. The loss due to seepage will depend on the type of liner used. The lake is planned for multiple uses - boating, fishing, wildlife enhancement, irrigation water storage, esthetic enhancement, and as an emergency water source.

In this Master Plan a well is the assumed lake water source. However, it is not possible to accurately predict what the sources and the availability of water in the north Phoenix area will be at the time of Phase II facility construction. It is expected that the already high demand for water oriented recreation will have increased. Based on these and other considerations, a

decision can be made at that time as to whether or not the wildlife/boating and fishing lake development will be undertaken.

#### C. BALLOON LAUNCH

Although Deer Valley Airport traffic control tower personnel were very receptive to having a hot air balloon launch site within the Cave Buttes area, serious consideration should be given to the effect this may have on the increased traffic volume projected for that airport.

#### D. TRAIL CONTINUITY

A continuous, uninterrupted hiking, bicycling, and equestrian trail will be developed throughout Cave Creek Wash from Cave Buttes Dam to the Arizona Canal. The trail will extend the length of the proposed Cave Creek Regional Park. An important consideration in the planning process for the Cave Buttes Recreation Area and Cave Creek Regional Park is the continuity of this trail. Some difficulties are encountered at the point the proposed trail is to cross the Central Arizona Project's Granite Reef Aqueduct.

Originally, a concrete wash siphon, 72 ft (22 m) wide and 195 ft (59.4 m) long, was planned to span the aqueduct. On closer inspection, the wash siphon was found to be unsuitable for equestrian and bicyclist traversal. Although the steep concrete slopes and energy dissipators could be overcome by hikers, horses probably would slip and be extremely skittish while crossing on the wash siphon. It would also be difficult for cyclists to cross. Three alternatives, two feasible, for crossing the Granite Reef Aqueduct at this point are outlined below.

1. Reroute the trail - On the south approach to the aqueduct, route the trail west along the alignment of the aqueduct for about one mile to the 7th Street Bridge, then east along the north side of the aqueduct to reconnect with the original alignment of the Cave Creek Regional Park trail. A right-of-way would need to be purchased or leased to acquire the land necessary for rerouting of the trail. The 7th Street Bridge would also need to be improved for safe equestrian crossing.
2. Erect a bridge - The other alternative would be to construct a bridge for use by hikers, bicyclists, and horseback riders, over the Granite Reef Aqueduct at a suitable location. Suitability would be determined based on existing and expected environmental factors, and on whether the integrity of a cohesive Cave Creek Regional Park trail would be maintained.
3. Fill a path - The City of Phoenix Parks and Recreation Department, the Bureau of Reclamation, and the Corps of Engineers met to view and discuss these problems. The Bureau of Reclamation suggested filling in a 12 ft (3.7 m) wide path through the siphon with pea gravel, but it was felt that the gravel would wash out easily in a 50-year flood.

#### E. LAGOON WATER SOURCE

An area of Cave Creek Wash along Deer Valley Drive is heavily disturbed by gravel mining. This area will be revegetated and the gravel pits left as lagoons. The lagoons will provide food, cover, and water for wildlife. The availability of water for the lagoons has not been established.

#### F. TRAILS THROUGH PROPOSED RETRIEVER TRAINING AREA AND COMBINED TRAINING AREA

Riding and hiking trails are planned to go through project lands that will from time to time be used for competitions involving either retrievers or combined training equestrian events. Foot and equestrian traffic on some trails could easily disrupt these competitive events, which often require that no distractions from nearby activity be permitted. To resolve this conflict, trails will be posted as closed on event days, and, where possible, trail traffic will be routed around the area where the event is to take place. Trails will remain blocked for the duration of the event. Other alternatives to resolve the conflicts between trail users and event participants will be explored and considered.

#### G. RADIO-CONTROLLED MODEL AIRPLANES

Model airplane hobbyists are currently using the area immediately north of Dike No. 2 as a runway and flight area for their planes. A local club of model fliers envisions this area as one of several "satellite" flight areas relative to their major planned facility at Reach 11 of the CAP Aqueduct. While the model airplane activity now occurring does not pose any problems, it is expected that conflicts will arise as more people use the area. Airplane noise is a common complaint from people living or recreating near model airplane flight areas. Residential subdivisions, a golf course, a picnic area, and a wildlife area are all foreseeable future land uses that may be affected by model aircraft noise coming from this site. Model airplane flying will also conflict with the recreation vehicle campground proposed in Phase II. The Maricopa County Parks and Recreation Department will make the final decision as to how these uses could best be accommodated.

#### H. LEASE BORROW SITES

The Flood Control District of Maricopa County has entered into a lease agreement permitting a private company to remove topsoil from designated areas just north of Cave Creek Dam. A front end loader and a truck are employed in the topsoil excavation. At this time, men and equipment operate three or four days a week, but the amount of work is dependent on current demand for topsoil. This operation will conflict to some degree with hiking and equestrian riding, picnicking, and dog training. The equipment noise and the large area of disturbed land will detract from the open space and park values that visitors will expect at Cave Buttes. These problems could only be reduced by restricting topsoil extraction operations to designated areas and by siting activity areas and trails as far as possible from these locations.

#### I. SPECIAL MEETS AND COMPETITIONS

Several times per year, the Cave Buttes Dam flood basin will serve as the site for meets and competitions of various types. Combined training enthusiasts, model airplane hobbyists, hot air balloonists, and retriever trainers have all expressed a desire to organize and stage events at Cave Buttes Dam. These events will draw more people, both spectators and participants, than the usual number of weekend visitors. Combined training events, for example, could draw anywhere from 300 people for a local event to several thousand for a regional or national event. The increased numbers of people could adversely impact other nearby activities, as well as the natural environment. Careful coordination, and the posting of warning and direction signs in some cases, would keep different activities from conflicting. Special parking provisions could be made by planning for overflow parking lots

on old borrow sites. Organizing and controlling access to the recreation activities would insure that competitors and spectators do not trample too much natural vegetation. In the case of events spanning two or more days, portions of old borrow areas could be reserved so that participants could camp at a location convenient to the event.

# **Conclusions**

## Chapter 11

### CONCLUSIONS

This master plan discusses the comprehensive development recommended for the Cave Buttes Dam basin. Based on the information presented here, the following conclusions can be made:

- a. The plan optimizes the use of land for flood control, open space, recreation development, and wildlife enhancement. The primary purpose of flood control will be maintained and the secondary purposes of recreation and open space will be provided.
- b. Implementation of the Cave Buttes Dam development plan will enhance recreation opportunities in Maricopa County.
- c. The recreation opportunities and improvements planned are in concert with the needs identified in the Statewide Comprehensive Outdoor Recreation Plan.
- d. Development of the plan will help meet the demands for certain types of day-use activities. Although the plan will not fulfill the market area's total recreation demand, it will significantly increase opportunities for dog and equestrian training, picnicking, trail and bicycle riding, hiking and jogging, field and court game activities of all kinds, and other recreation pursuits.
- e. Rapid urban growth in the Phoenix metropolitan area makes the Cave Buttes Dam basin valuable for recreation and open space.

f. Hydrologic and hydraulic considerations have been utilized in planning activities and their locations within the basin, including access and egress routes, to insure the safety of the user.

g. Trails planned within the basin will be integrated with regional trail systems.

h. The development plan optimizes the use of available project lands with respect to costs and future demands.

i. The development plan has strong local support from officials, local government agencies, and user groups.

j. The Maricopa County Parks and Recreation Department will operate and manage the resources in continuity with its management policies for regional parks.

# **Recommendations**

## Chapter 12

### RECOMMENDATIONS

It is recommended that this master plan be approved to serve as a general guide for future planning, design, development, and management of the project lands.

# **Appendix**

# OFFICE OF THE BOARD OF SUPERVISORS

MARICOPA COUNTY  
602 County Administration Bldg. 111 S. 3rd Avenue, Phoenix, Arizona 85003

TOM FREESTONE  
District 1

GEORGE L. CAMPBELL  
District 2

FRED KOORY, JR.  
District 3

HAWLEY ATKINSON  
District 4

ED PASTOR  
District 5



March 27, 1979

Colonel Gwynn A. Teague  
District Engineer/Executive Office  
U.S. Army Corps of Engineers  
300 Los Angeles Street  
Los Angeles, California 90012

Dear Colonel Teague:

At their formal meeting of March 19, 1979, the Maricopa County Board of Supervisors reaffirmed the County's interest in recreational development of the Cave Buttes Dam and the Adobe Dam floodplain areas, and elected to act as the local sponsoring agency.

Sincerely,

*Hawley Atkinson*  
Hawley Atkinson  
Chairman

A:M:v

CC: Mrs. Ruth Bajza Chase, Geographer  
U.S. Army Corps of Engineers  
2721 North Central Avenue, Suite 800  
Phoenix, Arizona 85004

Mr. Robert H. Milne, Director  
Maricopa County Parks & Recreation Dept.  
4701 East Washington Street  
Phoenix, Arizona 85034

# OFFICE OF THE BOARD OF SUPERVISORS

MARICOPA COUNTY BOARD OF SUPERVISORS  
602 County Administration Bldg. 111 S. 3rd Ave., Phoenix, Arizona 85003



RECEIVED

002-262-3416

MLW 28 1979

MARICOPA COUNTY  
RECREATION DEPARTMENT

MEMO TO: Robert H. Milne, Director  
Parks and Recreation Department

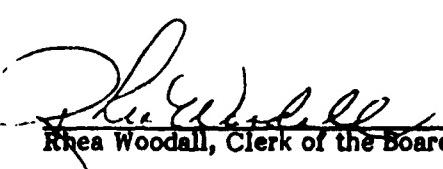
FROM: Rhea Woodall  
Clerk of the Board

DATE: March 26, 1979

SUBJECT: Letter of Intent Authorization

The Board of Supervisors, in formal session on March 19, 1979, authorized a Letter of Intent for the Maricopa County Parks and Recreation Department to be designated the local sponsoring agency of the open space associated with the construction of Cave Buttes and Adobe Dam Flood Control Structure.

Please forward a copy of the Letter of Intent to this office for our files.

  
Rhea Woodall, Clerk of the Board

RW:jp

TOM FREESTONE  
District 1

GEORGE L. CAMPBELL  
District 2

FRED KOORY, JR.  
District 3

HAWLEY ATKINSON  
District 4

ED PASTOR  
District 5

3 20 261 81

# OFFICE OF THE BOARD OF SUPERVISORS

MARICOPA COUNTY BOARD OF SUPERVISORS  
602 County Administration Bldg. 111 S. 3rd Ave., Phoenix, Arizona 85003



602-262-3415

Colonel Paul Taylor  
District Engineer  
Department of the Army  
Los Angeles District  
Corps of Engineers  
P. O. Box 2711  
Los Angeles, CA 90053

Dear Colonel Taylor:

In reply to your letter of January 15, 1981 to Robert Milne, Director of the Maricopa County Parks and Recreation Department, please be advised that the Maricopa County Board of Supervisors has taken positive action regarding their intent to execute the cost sharing agreement and provide funds for the initial development and the feature design memorandums of the Adobe Dam and Cave Buttes flood plain recreation areas. It is our understanding that the current estimated cost of the initial development at Cave Buttes is \$1,620,100.00 with a feature design memorandum cost of \$73,000.00 and that the current estimated cost of the initial development at Adobe is \$938,400.00 with a feature design memorandum cost of \$72,000.00.

It is our further understanding that no development will take place until authorized by Maricopa County and that this letter does not constitute authorization for expenditure of funds. Maricopa County has not appropriated funds for this purpose in the 1981-82 budget.

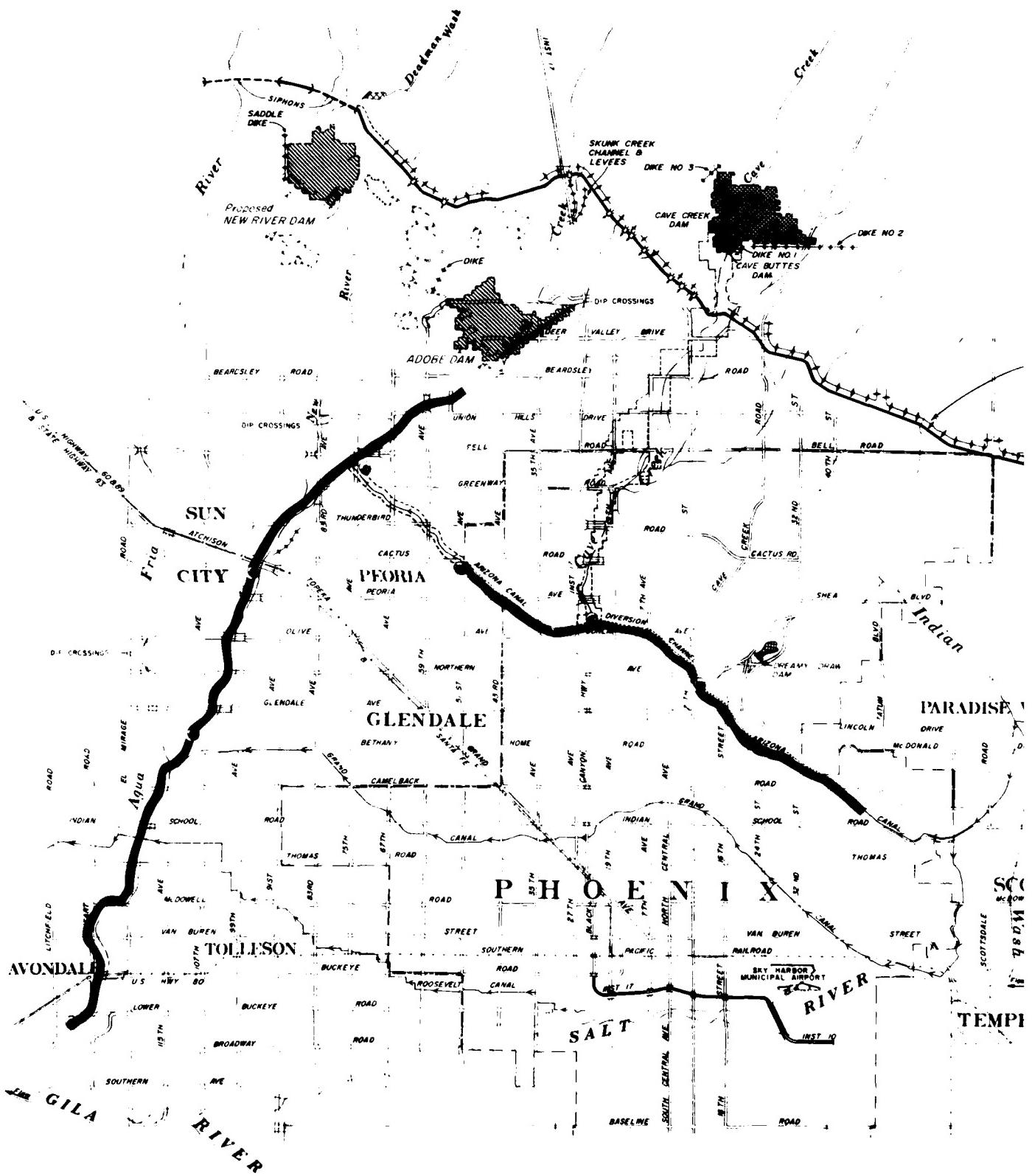
Sincerely,

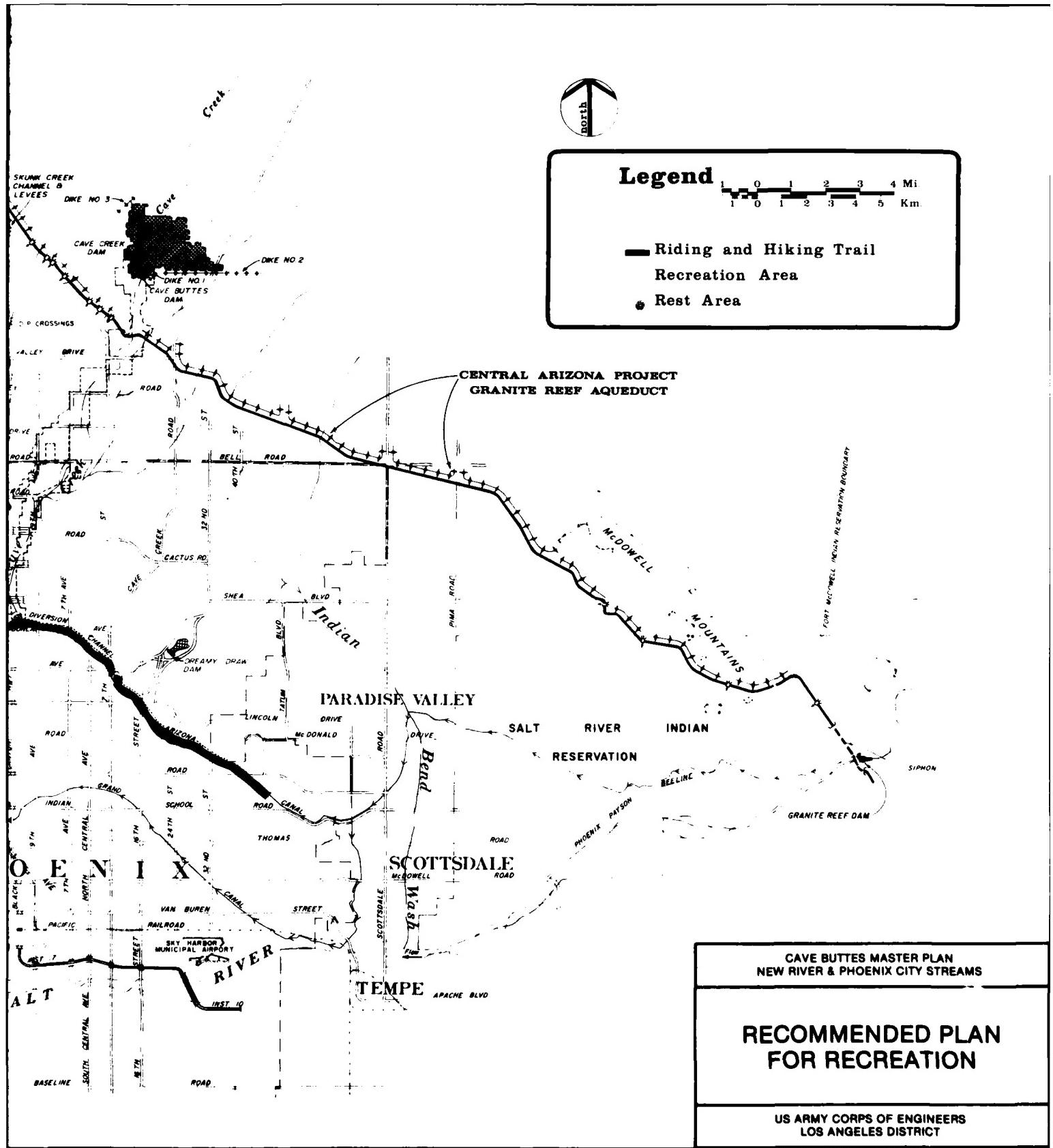
A handwritten signature in cursive ink that reads "Tom Freestone".

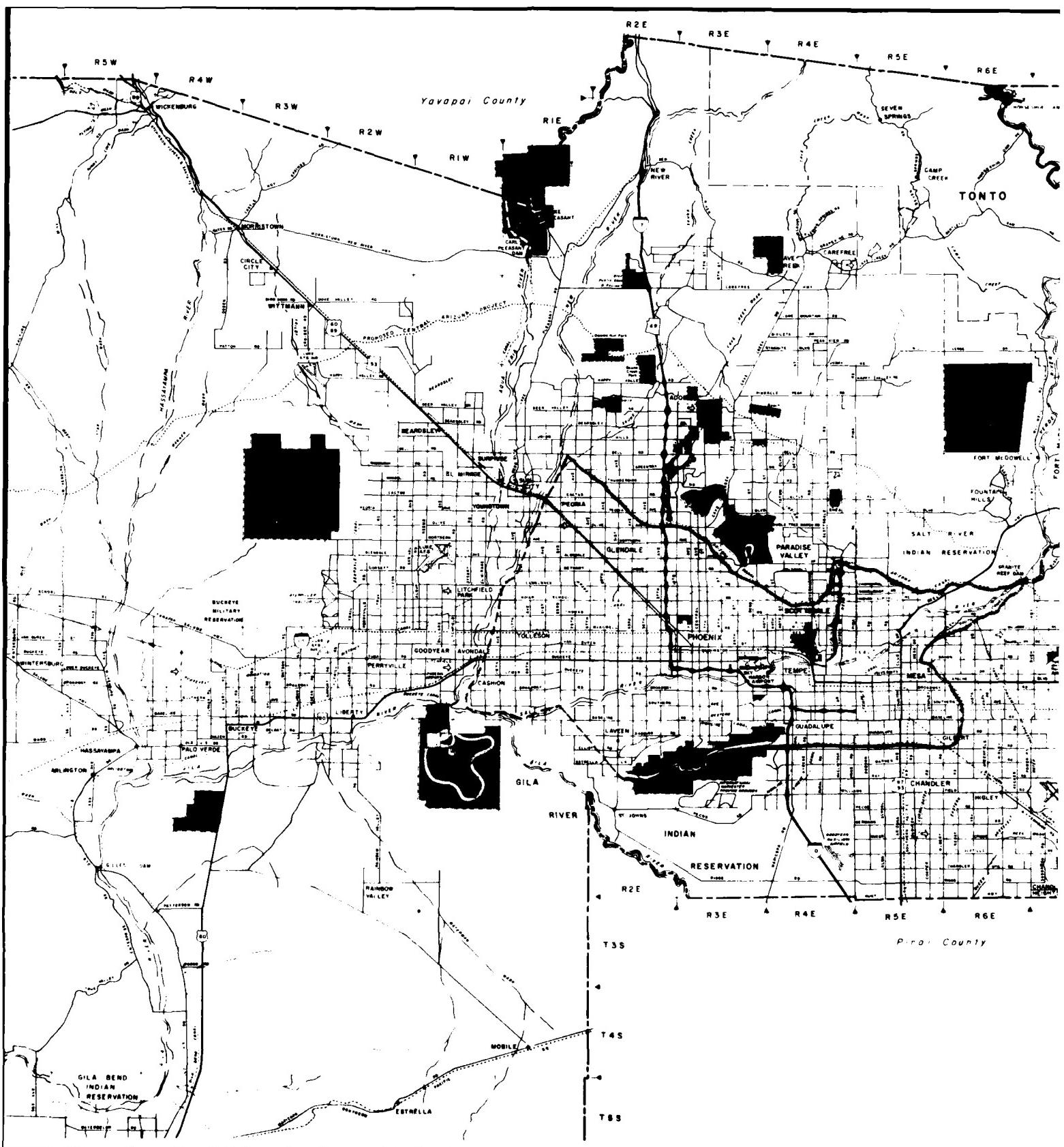
Tom Freestone, Chairman  
Board of Supervisors

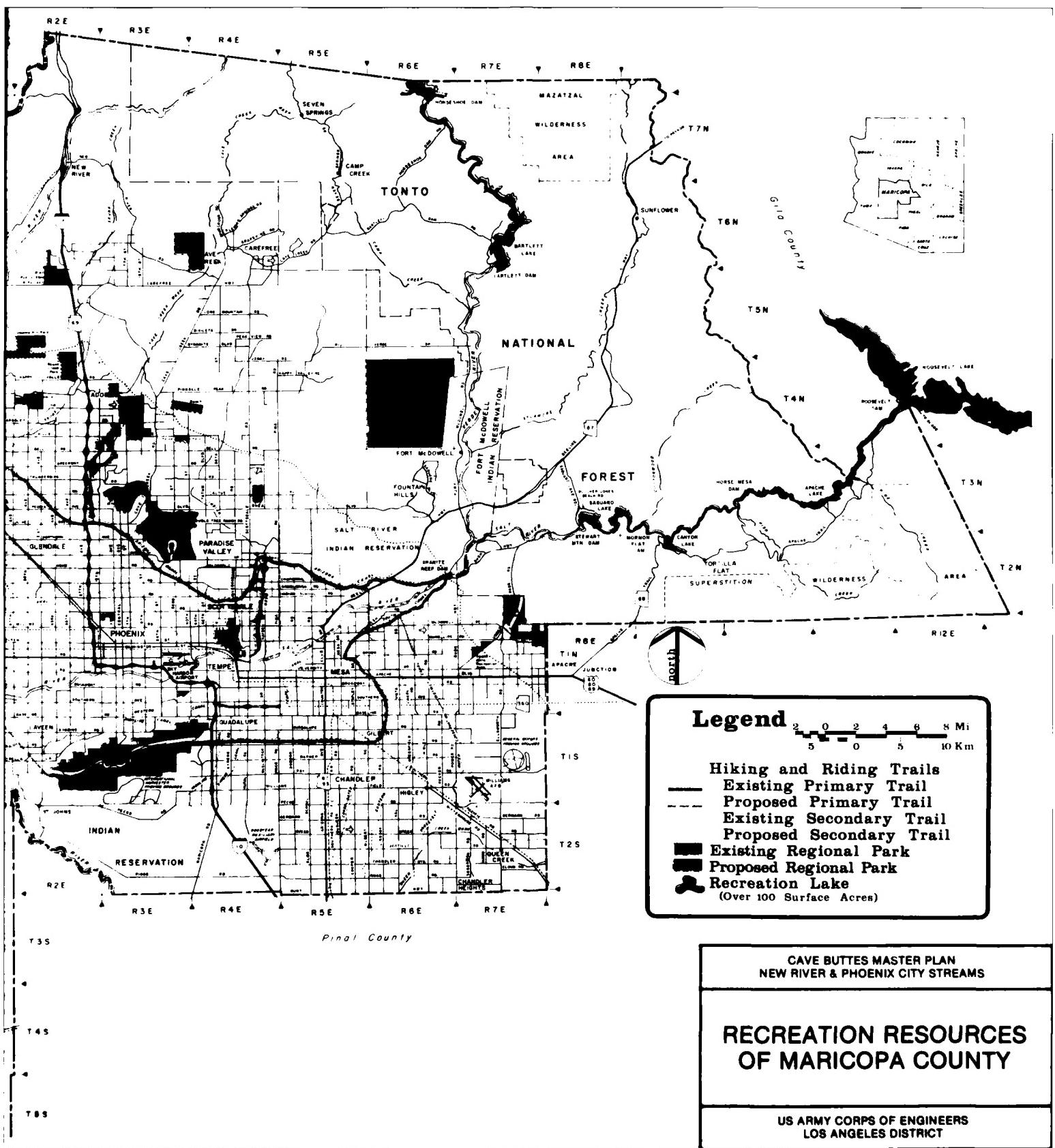
F:M:R:j

**Plates**





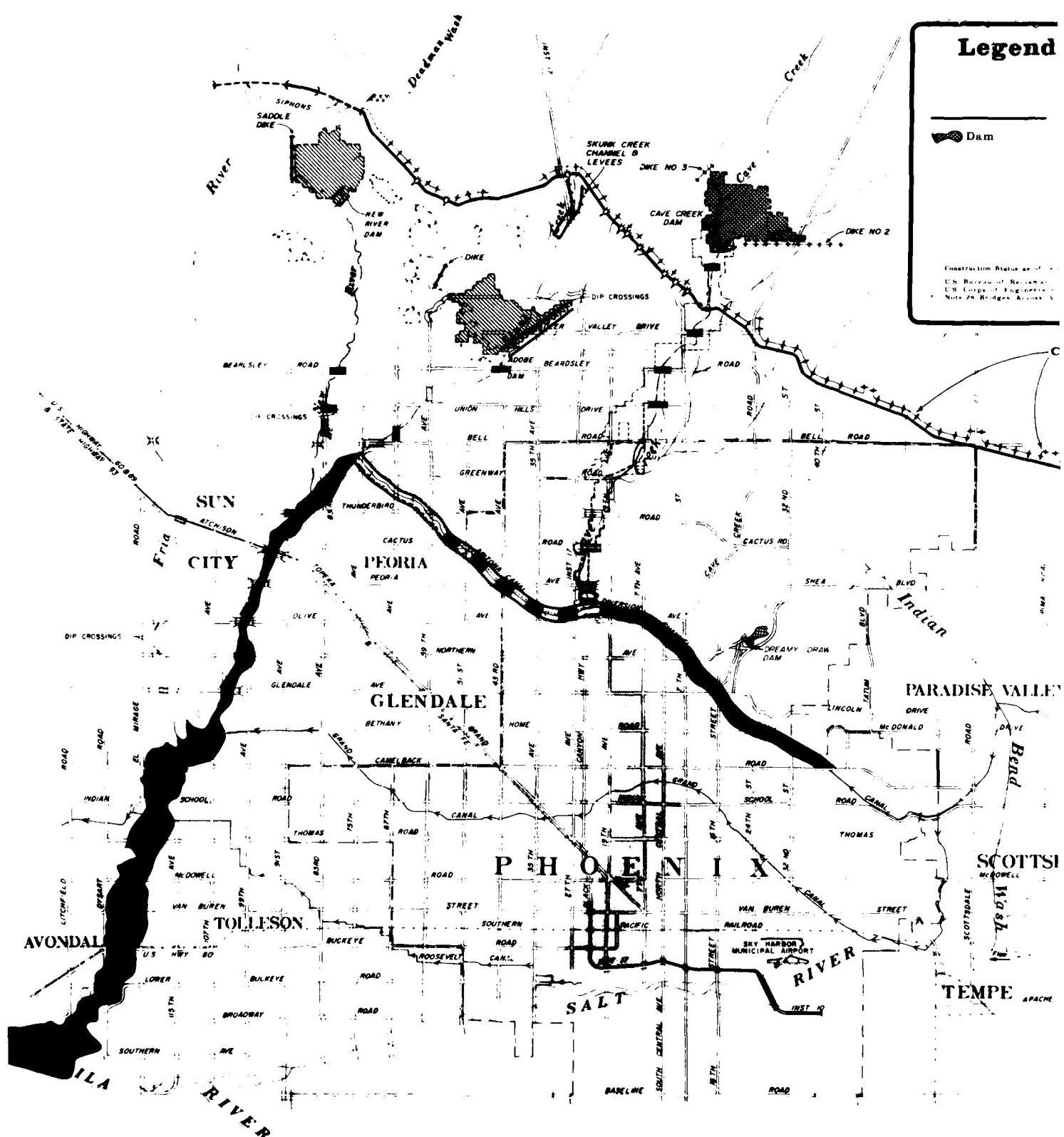


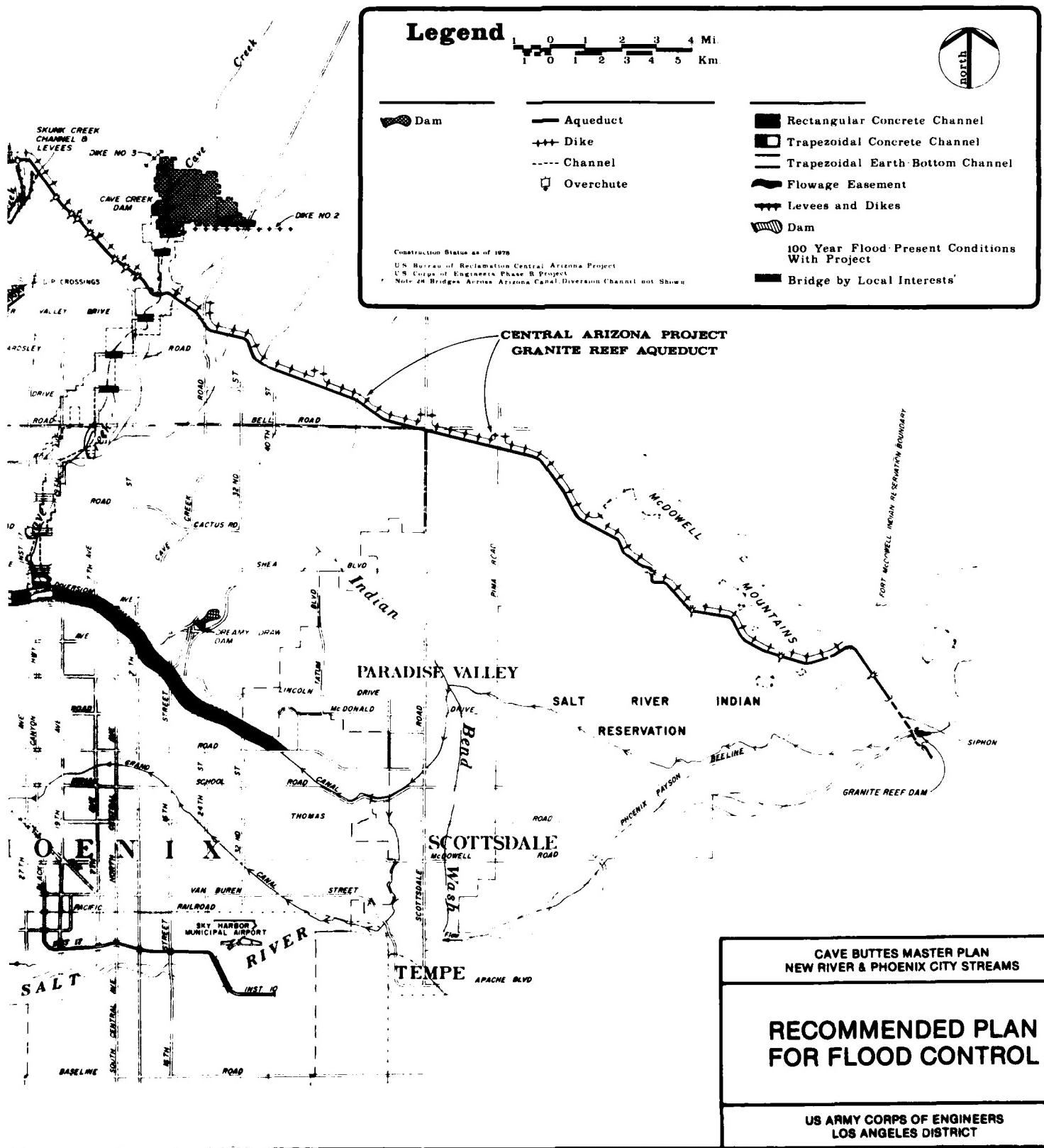


## Legend



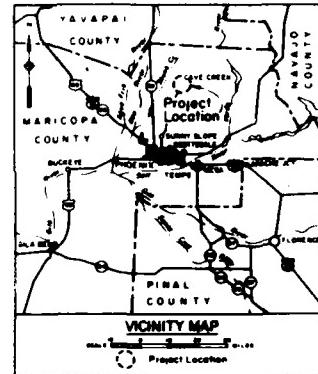
Construction Status as of 1960  
U.S. Bureau of Reclamation  
U.S. Corps of Engineers  
Note 28 Bridges Across A





DIKE NO. THREE





## LEGEND

25 YEAR FLOOD LINE  
(NO PERMANENT STRUCTURES)

25 TO 50 YEAR FLOOD  
(NO PERMANENT STRUCTURES)

50 TO 100 YEAR FLOOD

100 YEAR TO STANDARD PROJECT FLOOD

600 0 600 1200 1800 2400

GRAPHIC SCALE IN FEET

DIKE NO. TWO

CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

## FLOOD ZONES

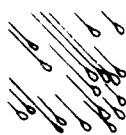
US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

PLATE 4

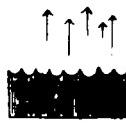
# CLIMATOLOGIC SUMMARY



TEMPERATURE



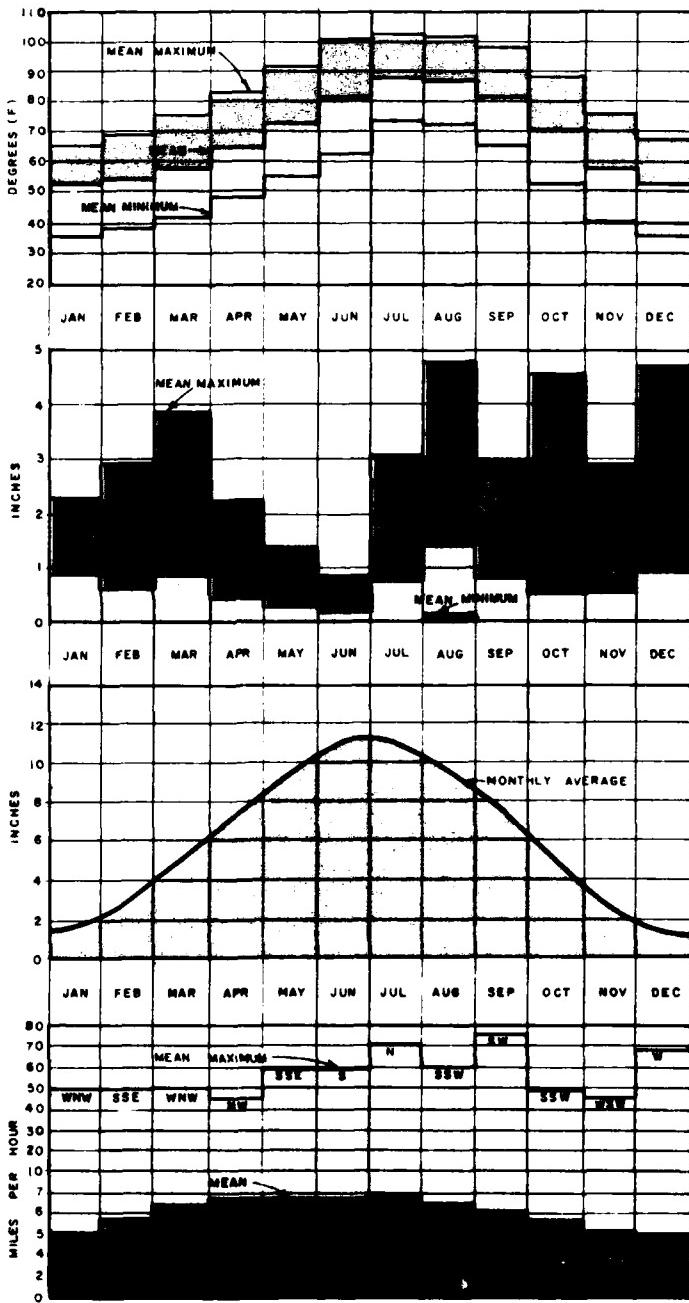
PRECIPITATION



EVAPORATION

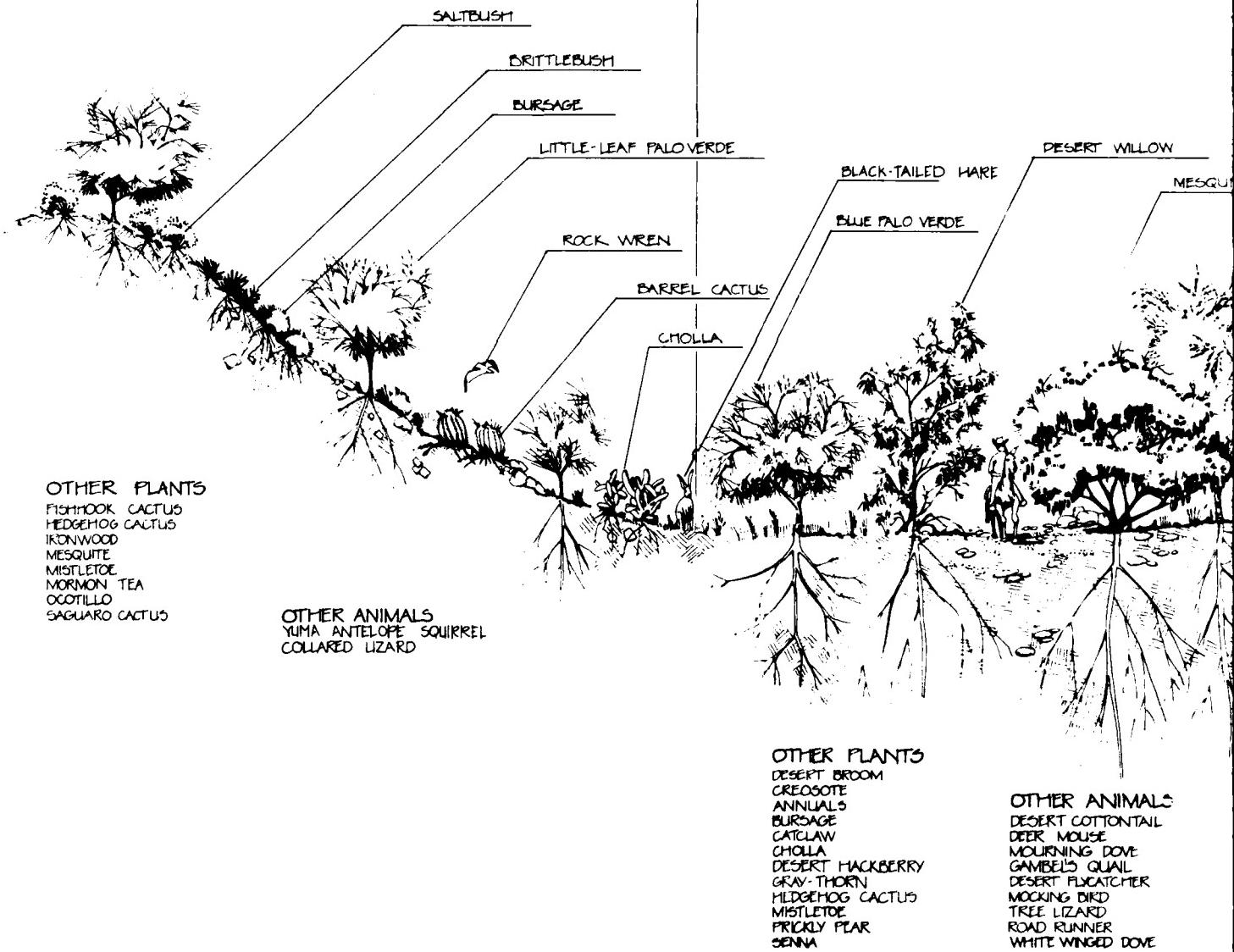


WIND

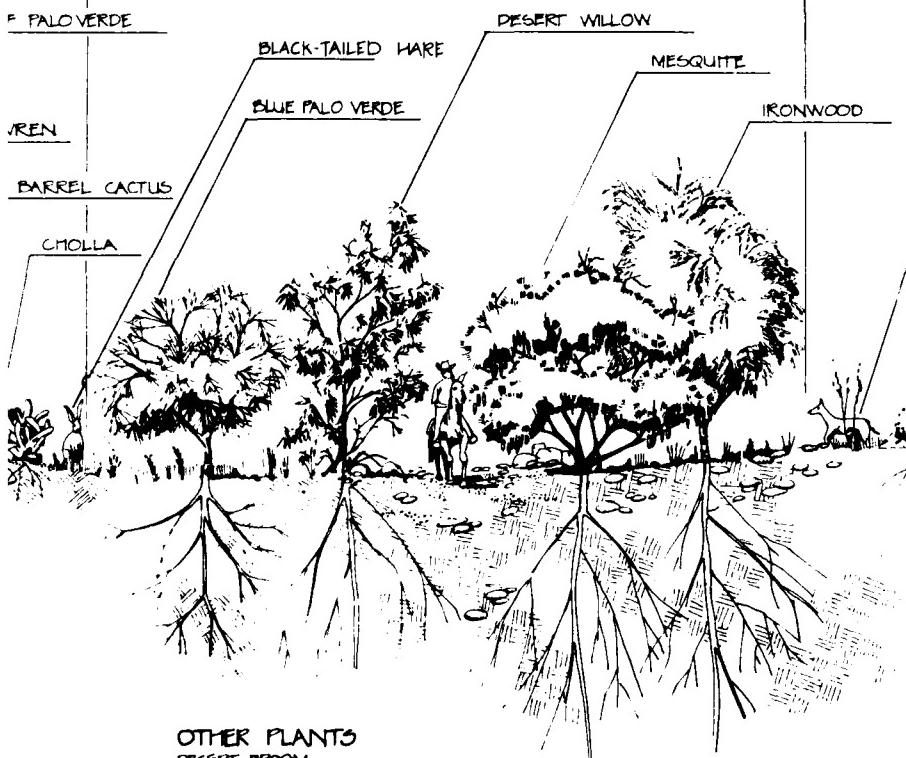


## FOOTHILLS

## STREAMBED



## STREAMBED



OTHER PLANTS  
DESERT BROOM  
CREOSOTE  
ANNUALS  
BURSAGE  
CATCLAW  
CHOLLA  
DESERT HACKBERRY  
GRAY THORN  
HEDGEHOG CACTUS  
MISTLETOE  
PRICKLY PEAR  
SENNA

OTHER ANIMALS  
DESERT COTTONTAIL  
DEER MOUSE  
MOURNING DOVE  
GAMBEL'S QUAIL  
DESERT FLYCATCHER  
MOCKING BIRD  
TREE LIZARD  
ROAD RUNNER  
WHITE WINGED DOVE

## FLATLANDS

### OTHER PLANTS

MESQUITE  
QUAIL BUSH  
CHOLLA  
DESERT HACKBERRY  
HEDGE-HOG CACTUS  
MISTLETOE  
PALO VERDE

FOUR WINGED SALT BRUSH  
BARREL CACTUS  
BURSAGE  
FISHHOOK CACTUS  
IRONWOOD  
OCOTILLO  
SAQUARO

### OTHER ANIMALS

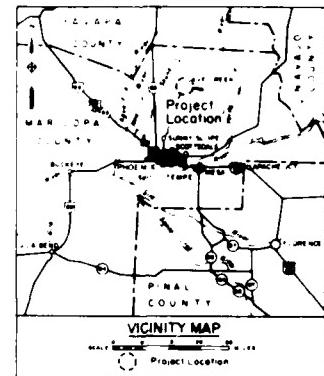
MULE DEER  
LEOPARD LIZARD  
DIAMOND BACK RATTLESNAKE  
WESTERN HARVEST MOUSE  
BADGER

CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

CROSS SECTION  
OF ECOSYSTEM

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT





## LEGEND

### CREOSOTE-BURSAGE ASSOCIATION

[Solid black square] CREOSOTE-BURSAGE/  
PALO VERDE ASSOC.

[Small cluster of dots] CREOSOTE-BURSAGE/  
CHOLLA ASSOC.

[Dashed line with small dots] PALO VERDE-BURSAGE ASSOC.

[Dashed line with small dots] PALO VERDE-BURSAGE/  
CHOLLA ASSOC.

[Solid black rectangle] HYDROSEEDED-ARTIFICIALLY PLANTED AREAS

HERBACIOUS-MEADOWLAND

[Small cluster of dots] CONCENTRATIONS OF  
MESQUITE, PALO VERDE, &  
IRONWOOD

[Dashed circle] BORROW AREAS

600 0 600 1200 1800 2400

GRAPHIC SCALE IN FEET

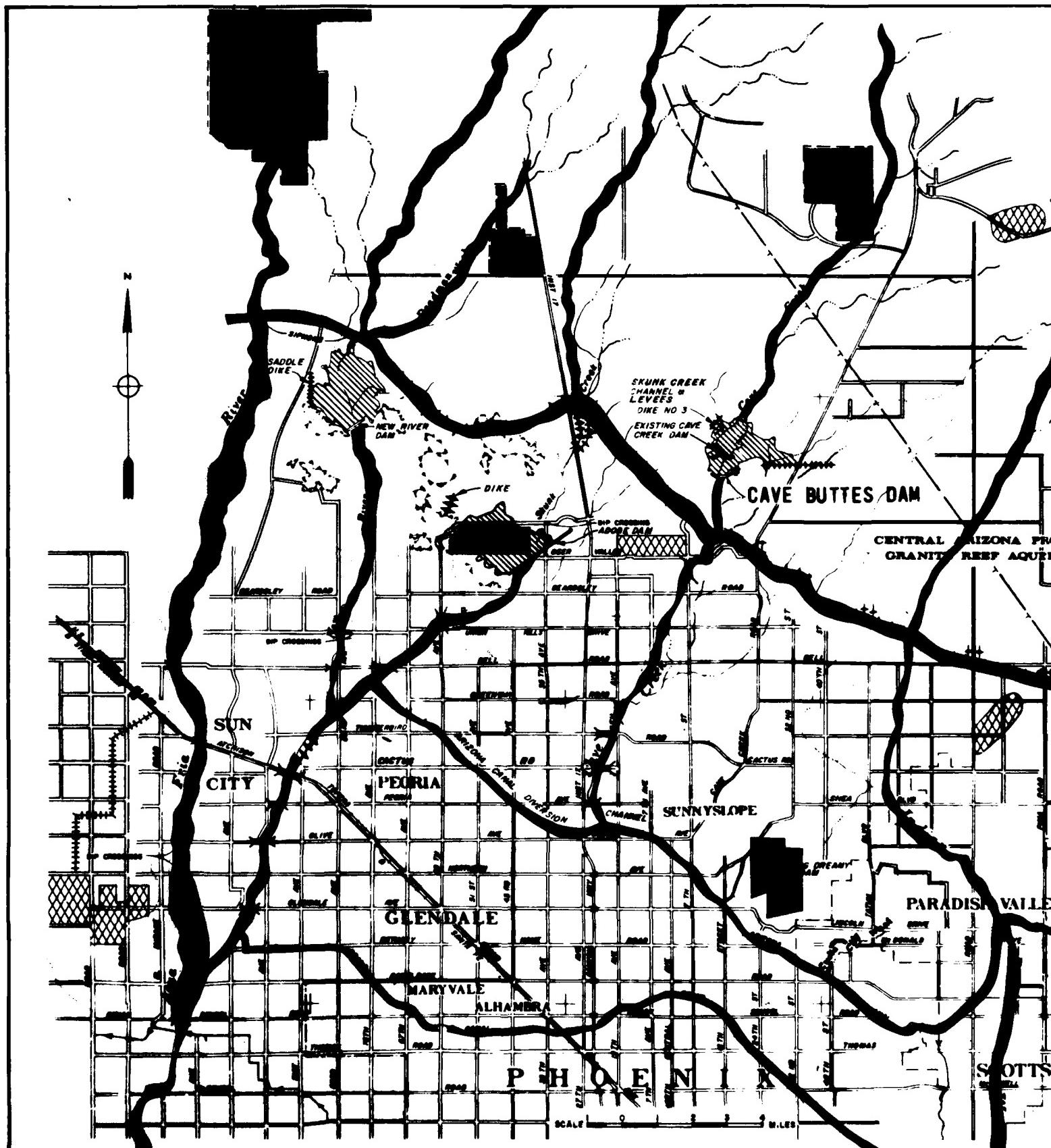
DIKE NO. TWO

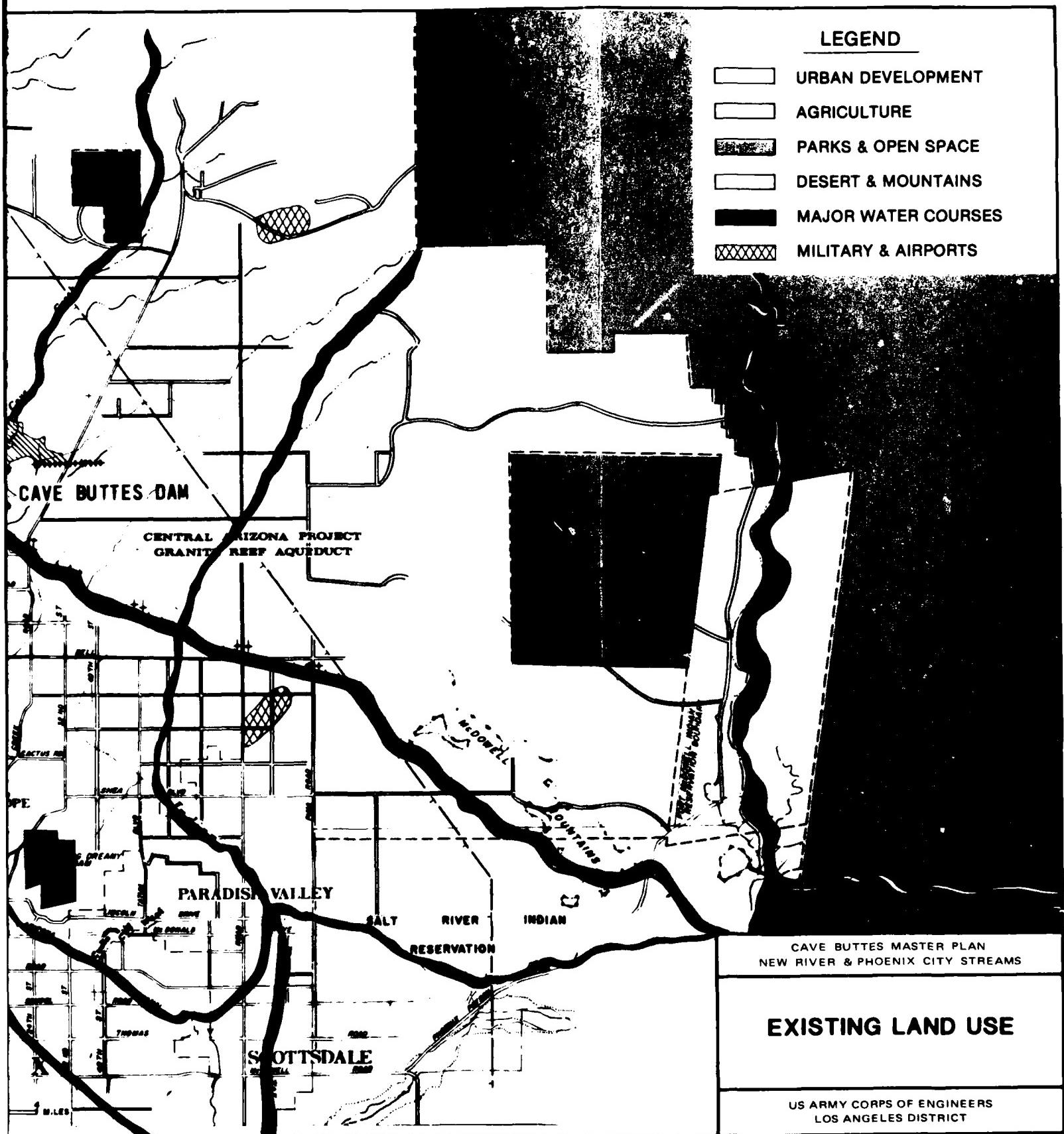
CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

## VEGETATION

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

PLATE 7





DIKE NO. THREE

WASH

NOTE: THE SIZE OF THE DESIGNATED BORROW AREAS ARE APPROXIMATELY AS SHOWN. AFTER EXCAVATION THE BORROW AREAS MAY BE USED TO DISPOSE OF WASTE MATERIALS SUCH AS UNSUITABLE MATERIAL FROM SPILLWAY, BYPASS CHANNEL EXCAVATION AND OTHER EXCAVATION.

PREVAILING WIND VELOCITY 6 MPH



RAINFALL  
AVE. ANNUAL 7.5"

SERIES OF MOUNTAIN RANGES (10 MILES NORTH)  
FORM DRAMATIC PATTERNS AGAINST SKY  
SEEN FROM ANY POINT IN BASIN

APACHE

CAVE

AREA OF FREQUENT FLOODING  
OCCASIONAL FLASH FLOOD

BYPASS  
CHANNEL

SAFETY FENCE

OVERLOOK & SUNDIAL

CAVE CREEK DAM

OVERLOOK RC

DRAINAGE C.

DIKE NO.

CAVE BUTTES  
SPILLWAY

CAVE BUTTES  
DAM

DIKE  
NO. ONE

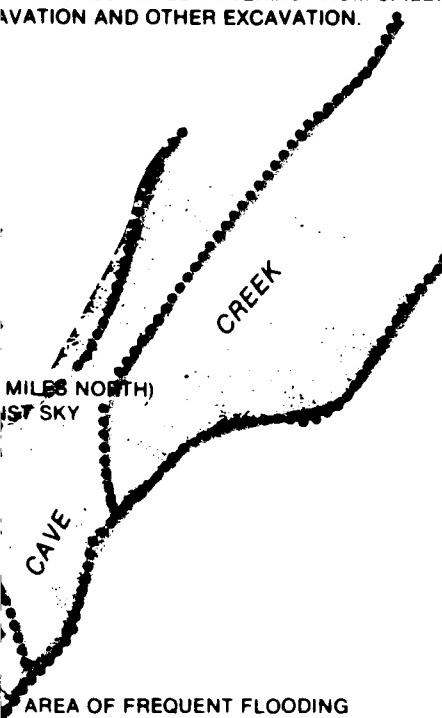
OUTLET WORKS

ACCESS ROAD

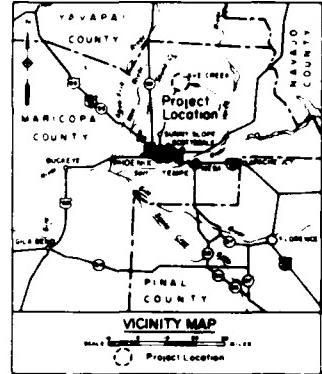
AFTERNOON SUN

MORN

DESIGNATED BORROW AREAS ARE APPROXIMATE.  
BORROW AREAS MAY BE USED TO DISPOSE OF  
SUCH AS UNSUITABLE MATERIAL FROM SPILLWAY AND  
AVATION AND OTHER EXCAVATION.



AREA OF FREQUENT FLOODING  
OCCASIONAL FLASH FLOOD



## LEGEND

BORROW AREAS

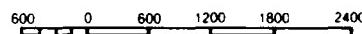
NATURALLY EXISTING  
EQUESTRIAN ROUTES  
EXISTING DIRT ROADS



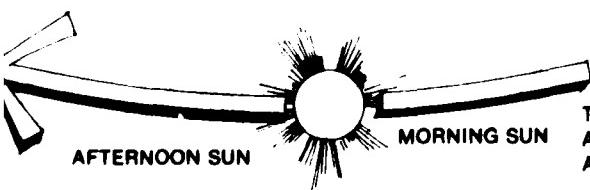
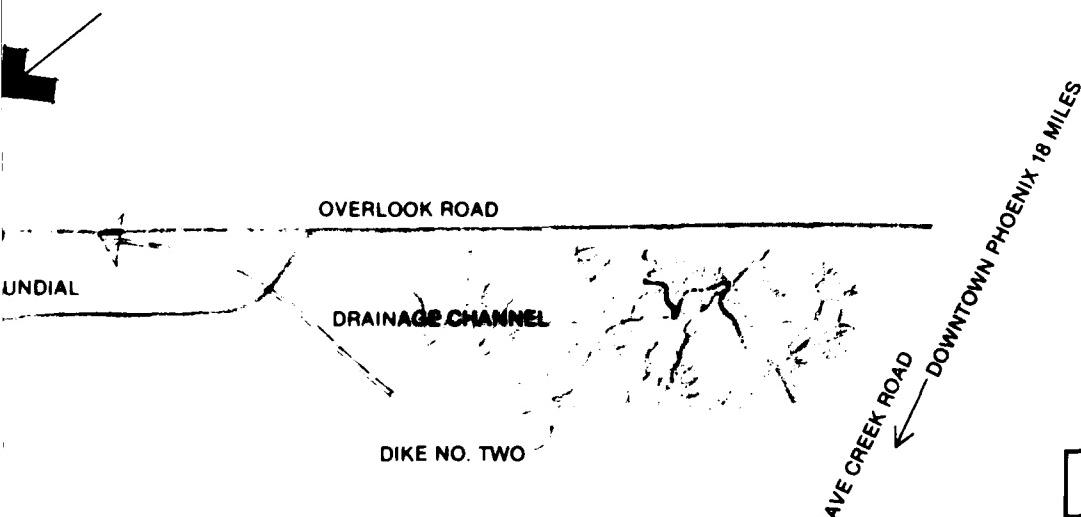
FREQUENTLY  
INUNDATED AREAS



SIGNIFICANT VIEWS  
OVERFLOW  
WATER COURSES



GRAPHIC SCALE IN FEET



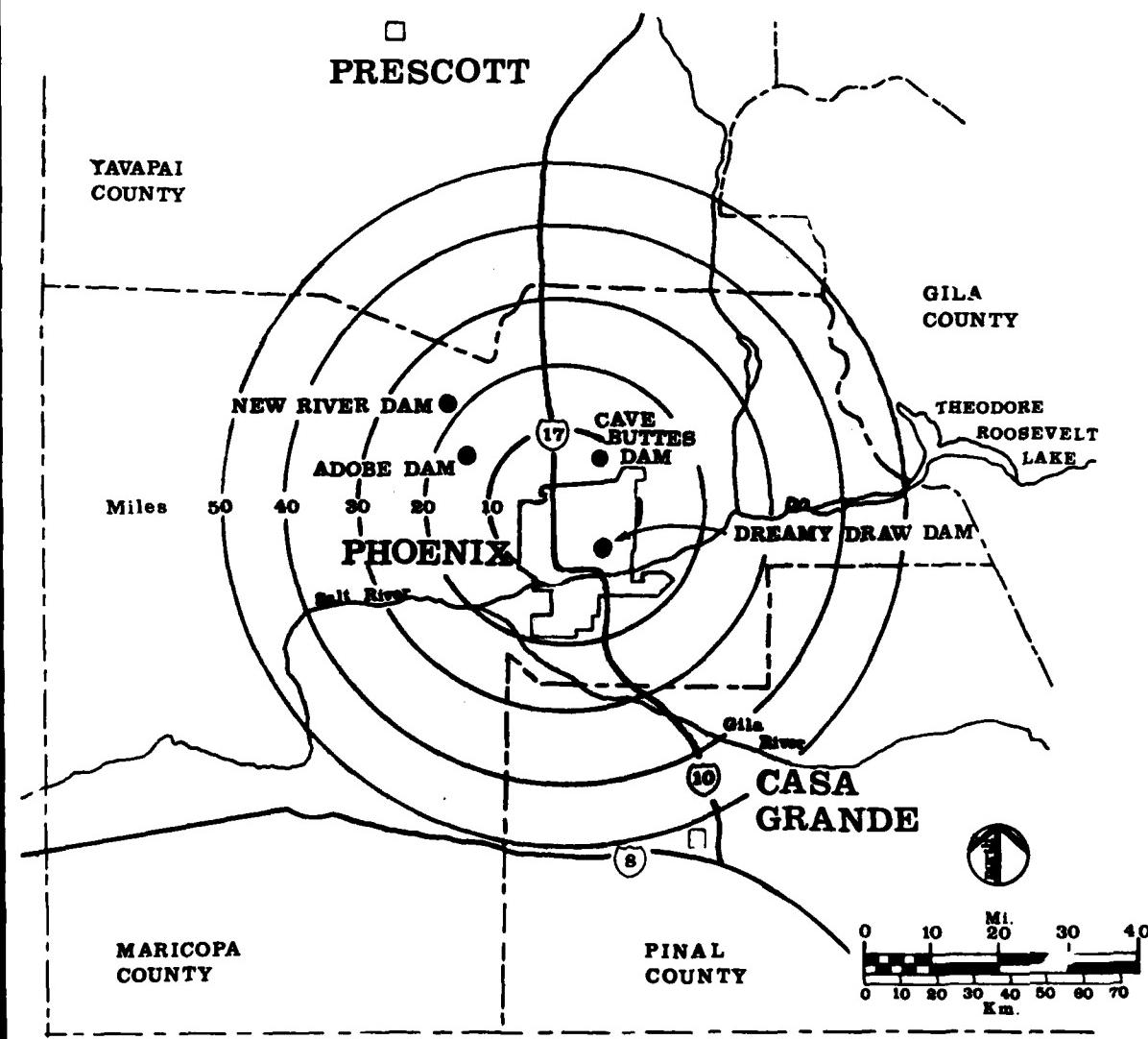
TEMPERATURE  
AVE. MAX. 85°F  
AVE. MIN. 56°F

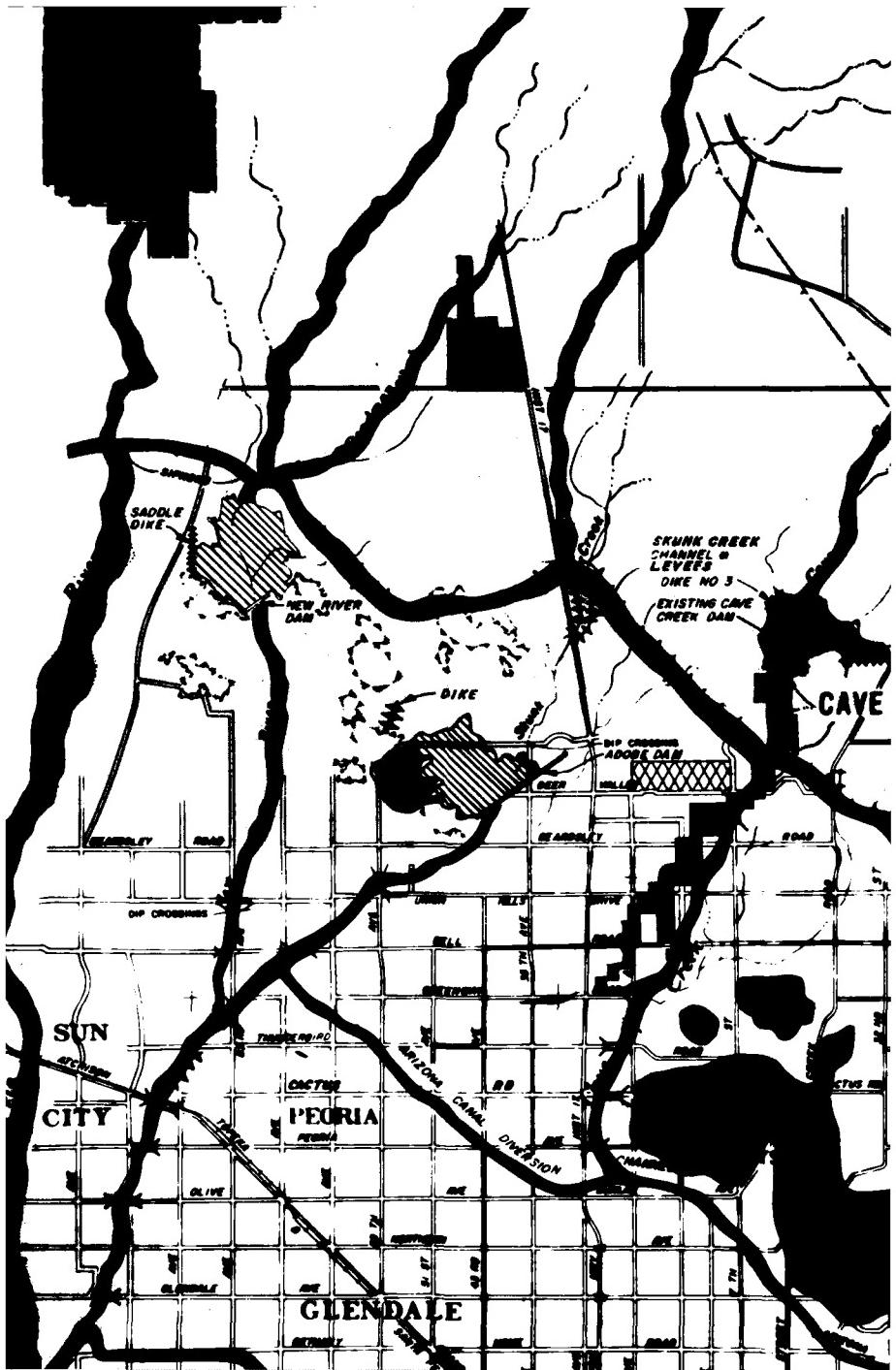
CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

## SITE ANALYSIS

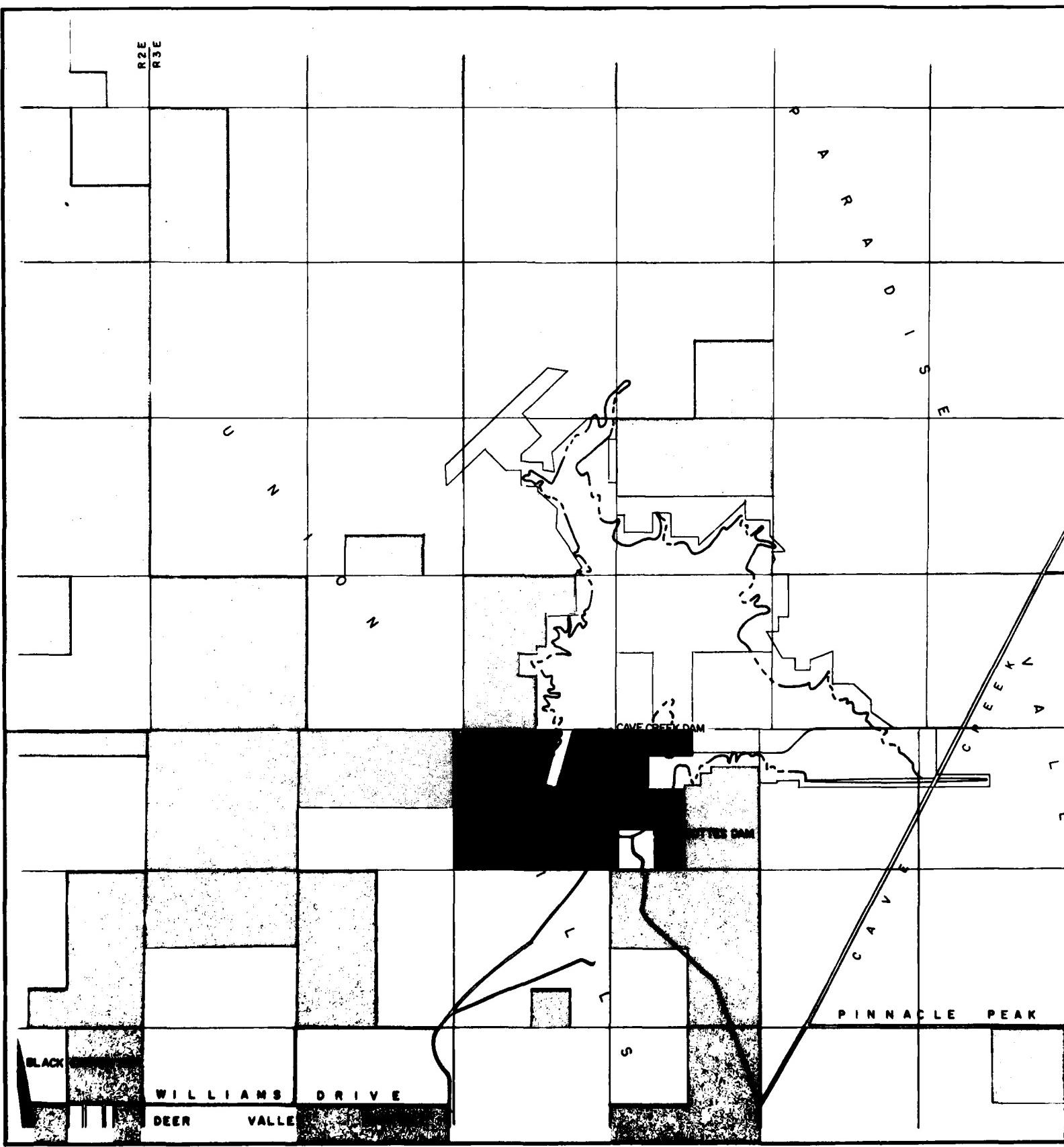
US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

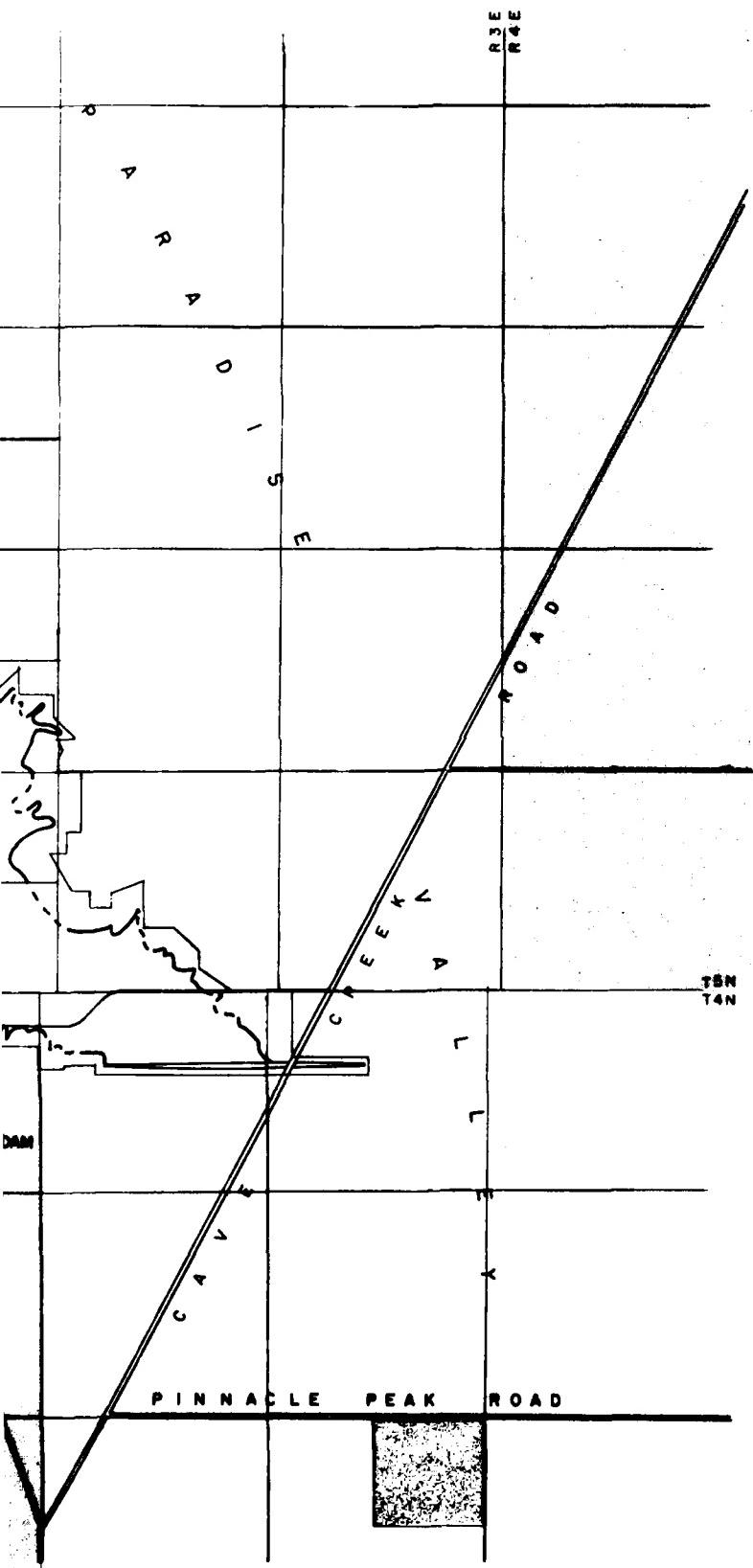
# New River and Phoenix City Streams, Arizona Recreation Market Area





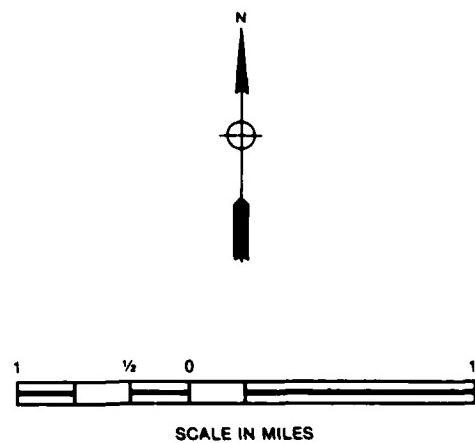






### LEGEND

- U.S. BUREAU OF LAND MANAGEMENT
- PRIVATELY HELD
- ARIZONA STATE LANDS
- FLOOD CONTROL DISTRICT  
OF MARICOPA COUNTY



CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

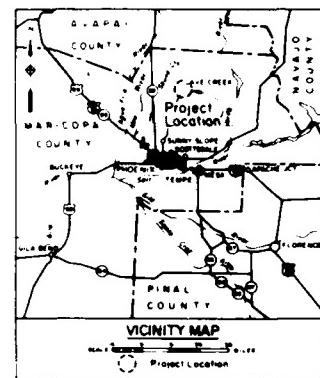
### LAND OWNERSHIP

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

PLATE 12

DIKE NO. THREE





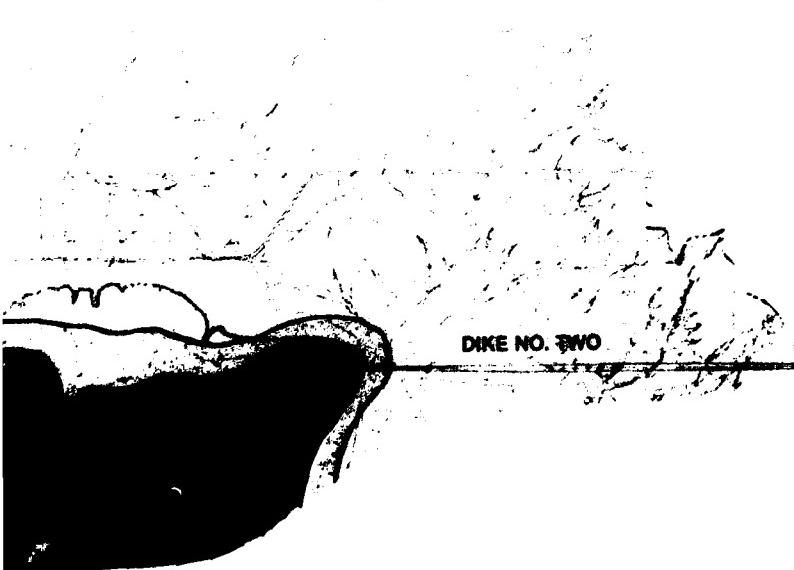
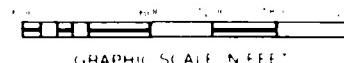
## LEGEND

AREAS OF LESS THAN 5% SLOPE  
VIRTUALLY FLAT

AREAS OF 5-10% SLOPE  
EASY GRADES

■ AREAS OF 10-20% SLOPE  
STEEP, UPWARD MOVEMENT REQUIRES EFFORT  
CONSTRUCTION IS DIFFICULT

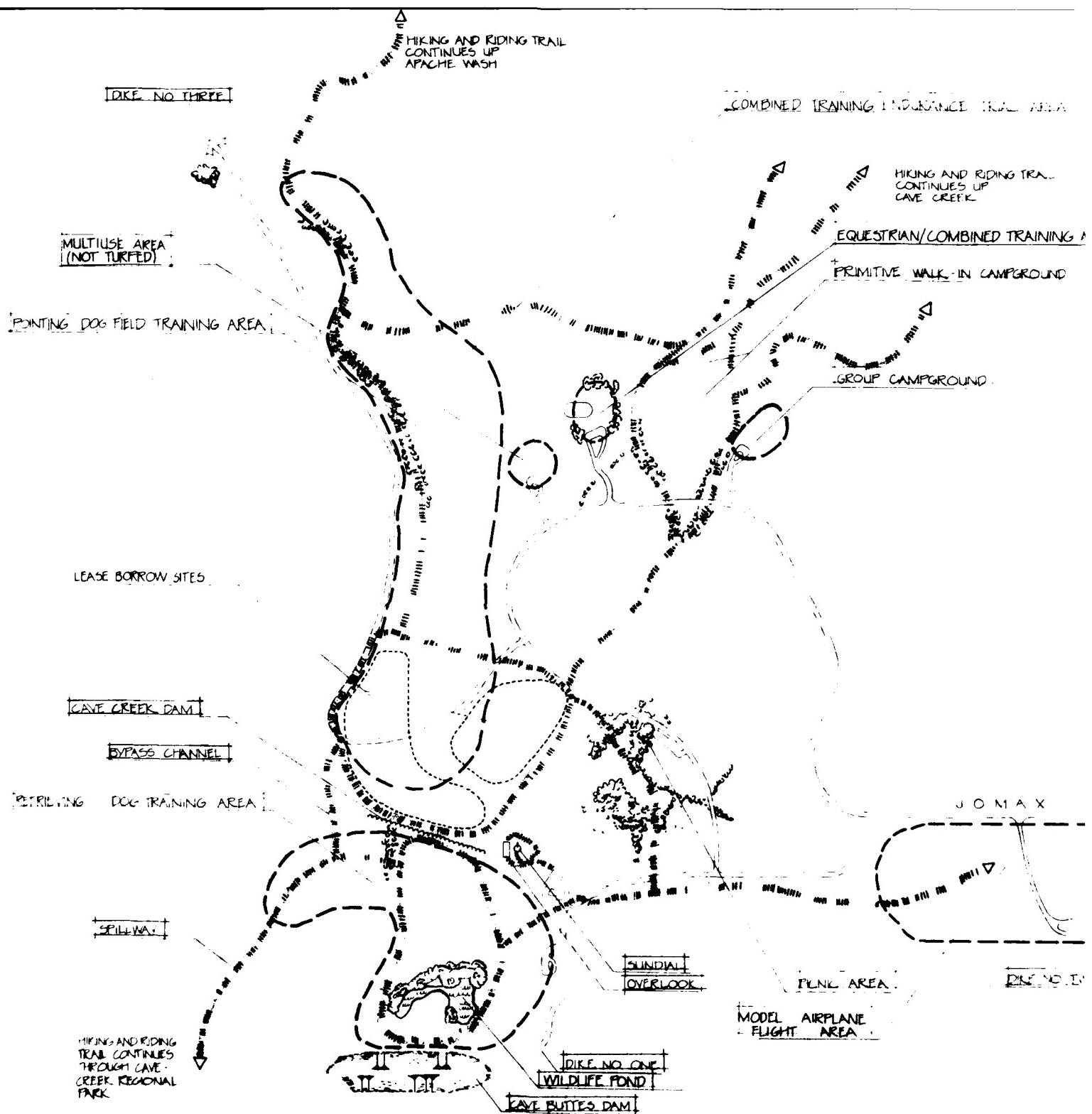
■ AREAS OF OVER 20% SLOPE  
CONSTRUCTION IS INFEASIBLE,  
POSSIBLE SEVERE EROSION & DRAINAGE PROBLEMS



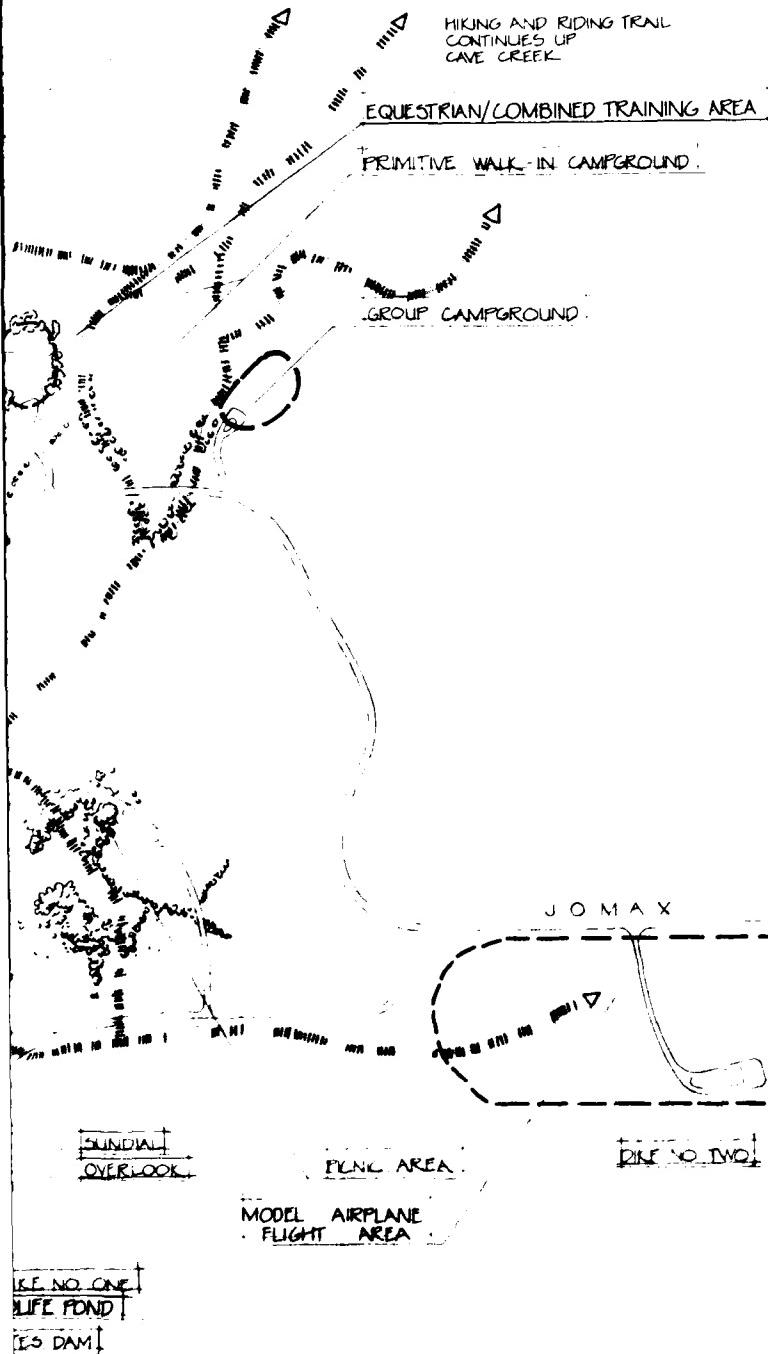
CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

## SLOPE ANALYSIS

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT



COMBINED TRAINING ENDURANCE TRAIL AREA



## LEGEND

PAVED AUTOMOBILE ROAD WITH BIKE LANE

PARKING CIRCLE  
FLOOD CONTROL MAINTENANCE  
ROAD ('DIRT')

HIKING/RIDING TRAIL

DENSE VEGETATION

ACTIVITY AREA

## FUNDING

FLOOD CONTROL ITEM

COST SHARED RECREATION  
(50% LOCAL, 50% FEDERAL)

NON-COST SHARED RECREATION  
(100% LOCAL)

WILDLIFE ENHANCEMENT  
(25% LOCAL, 75% FEDERAL)

400 0 250  
SCALE IN METERS

600 0 300 200 180 1200  
SCALE IN FEET

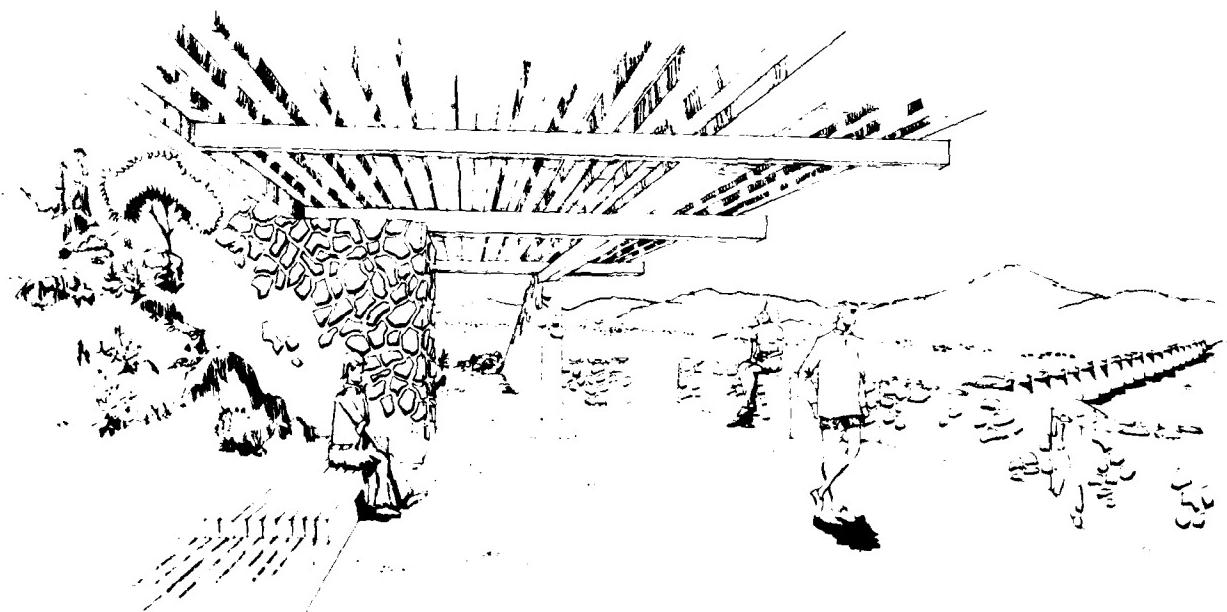
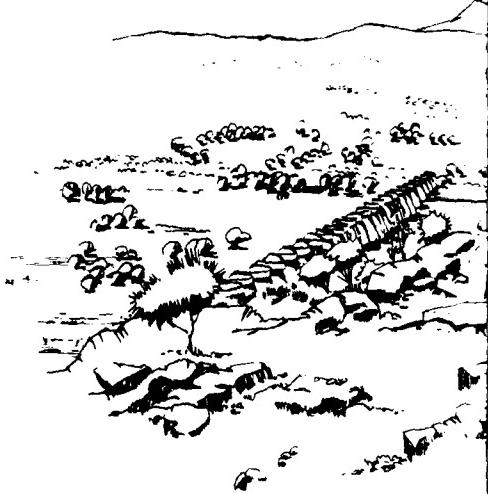
CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

SITE PLAN  
PHASE 1

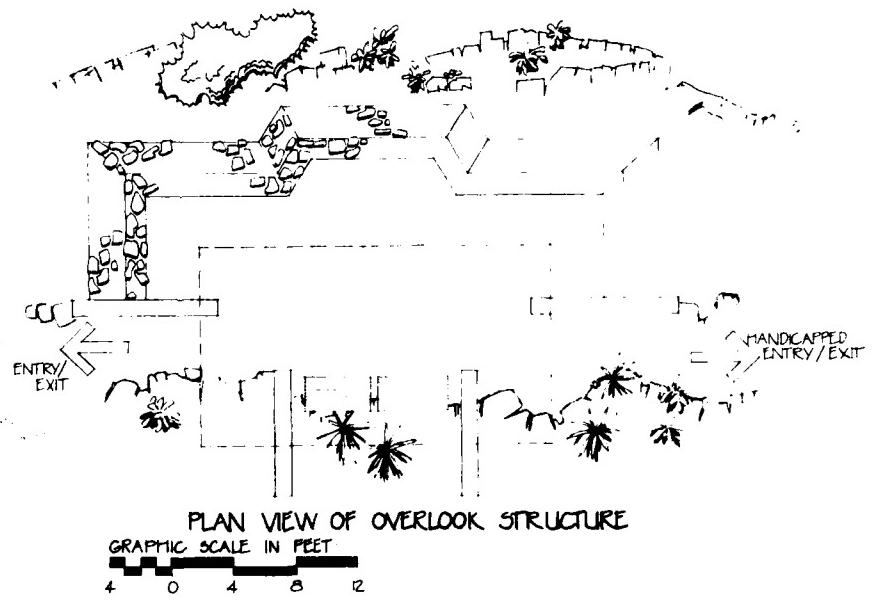
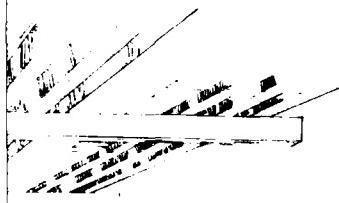
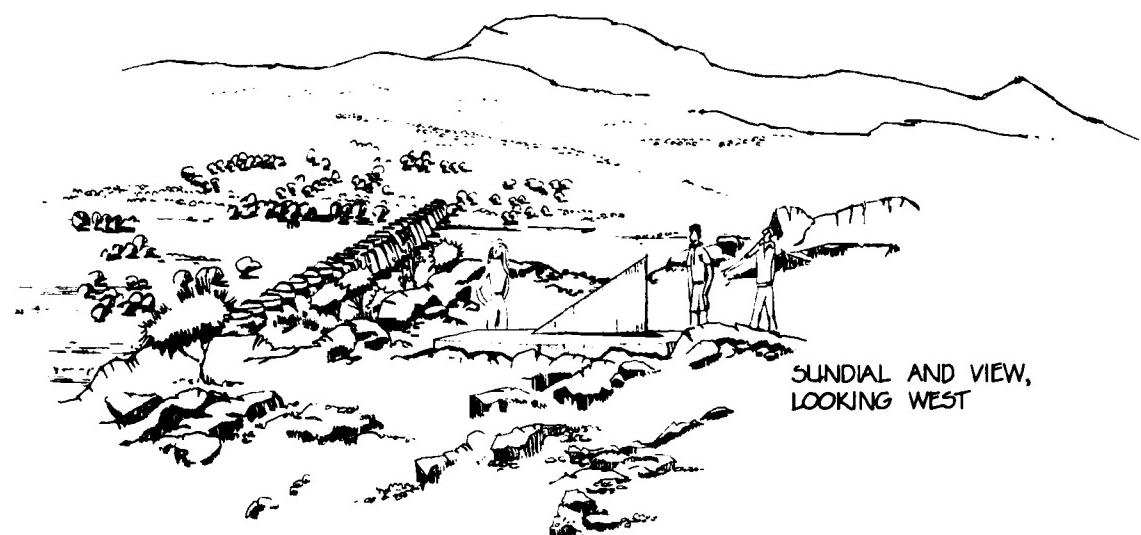
US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT



OVERLOOK - LOOKING EAST



OVERLOOK STRUCTURE. LOOKING SOUTH

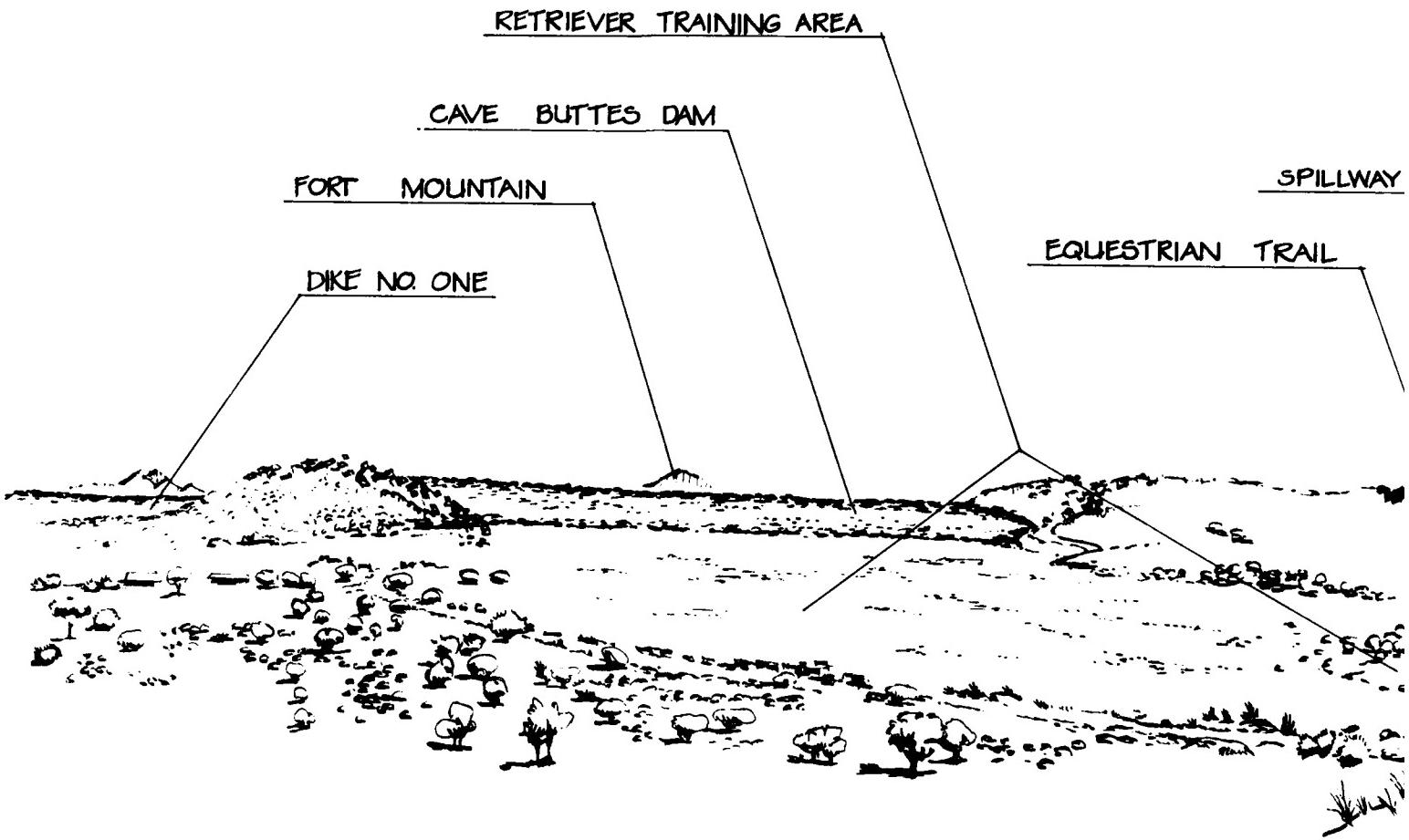


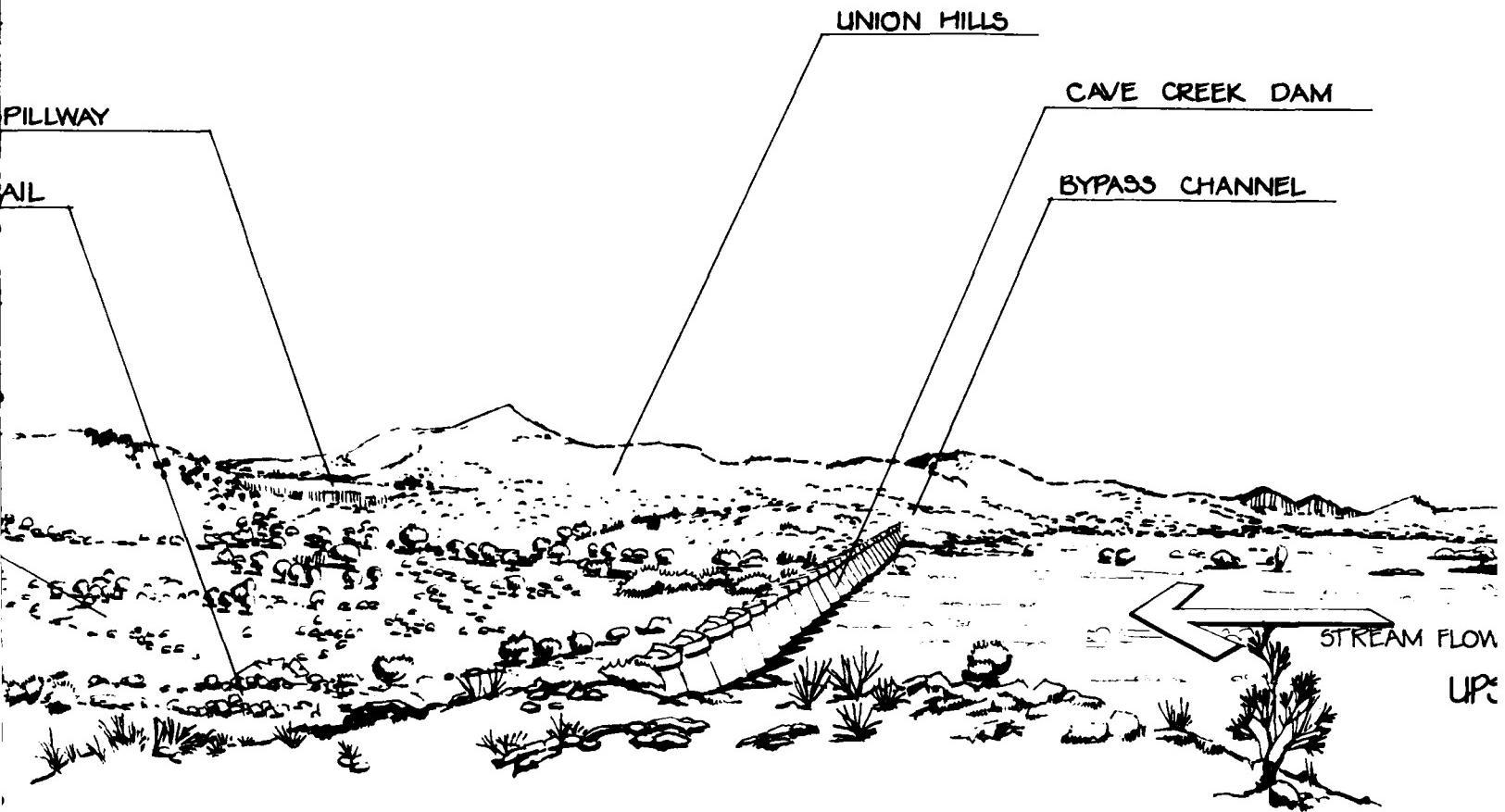
E. LOOKING SOUTH

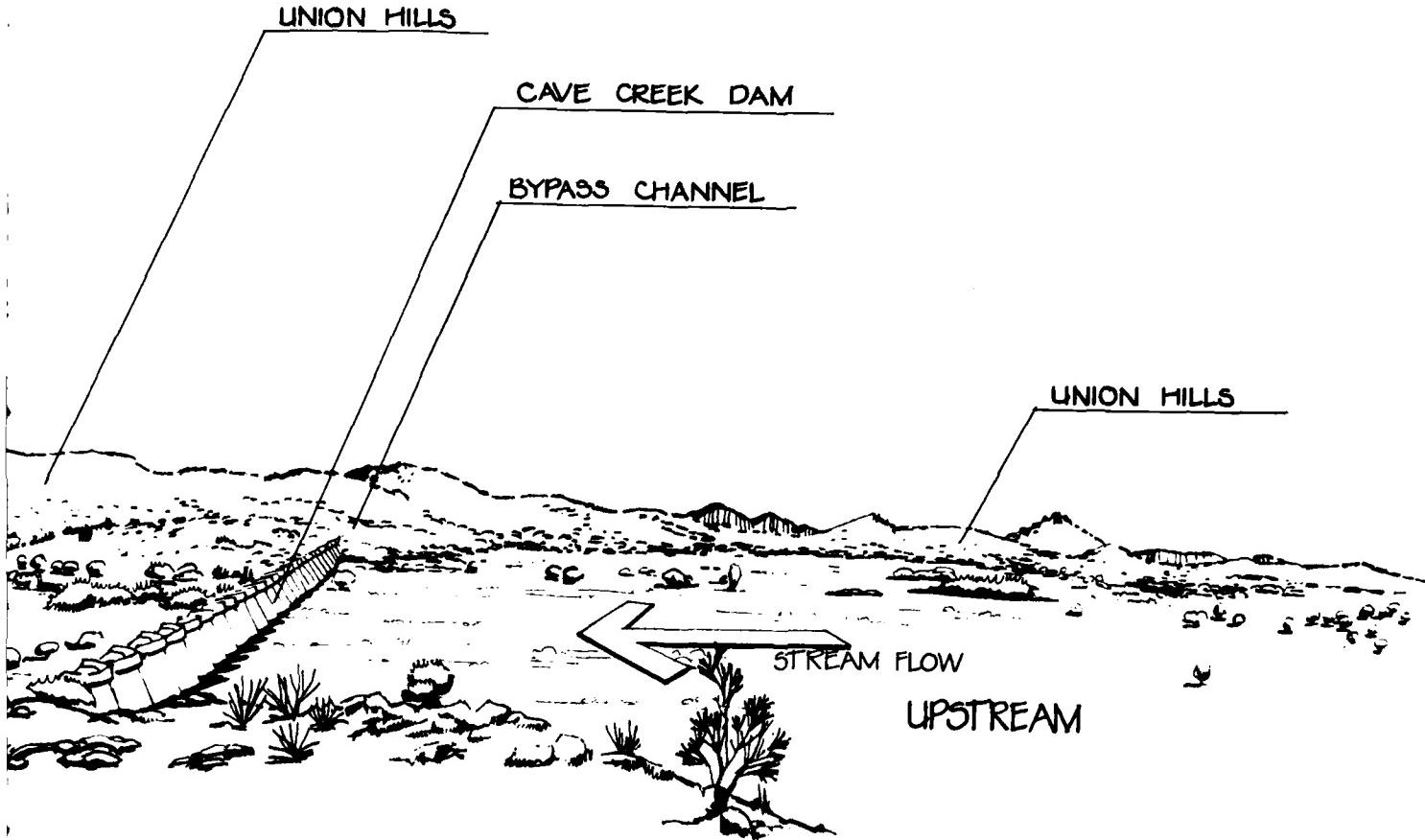
CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

## OVERLOOK AND SUNDIAL

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT





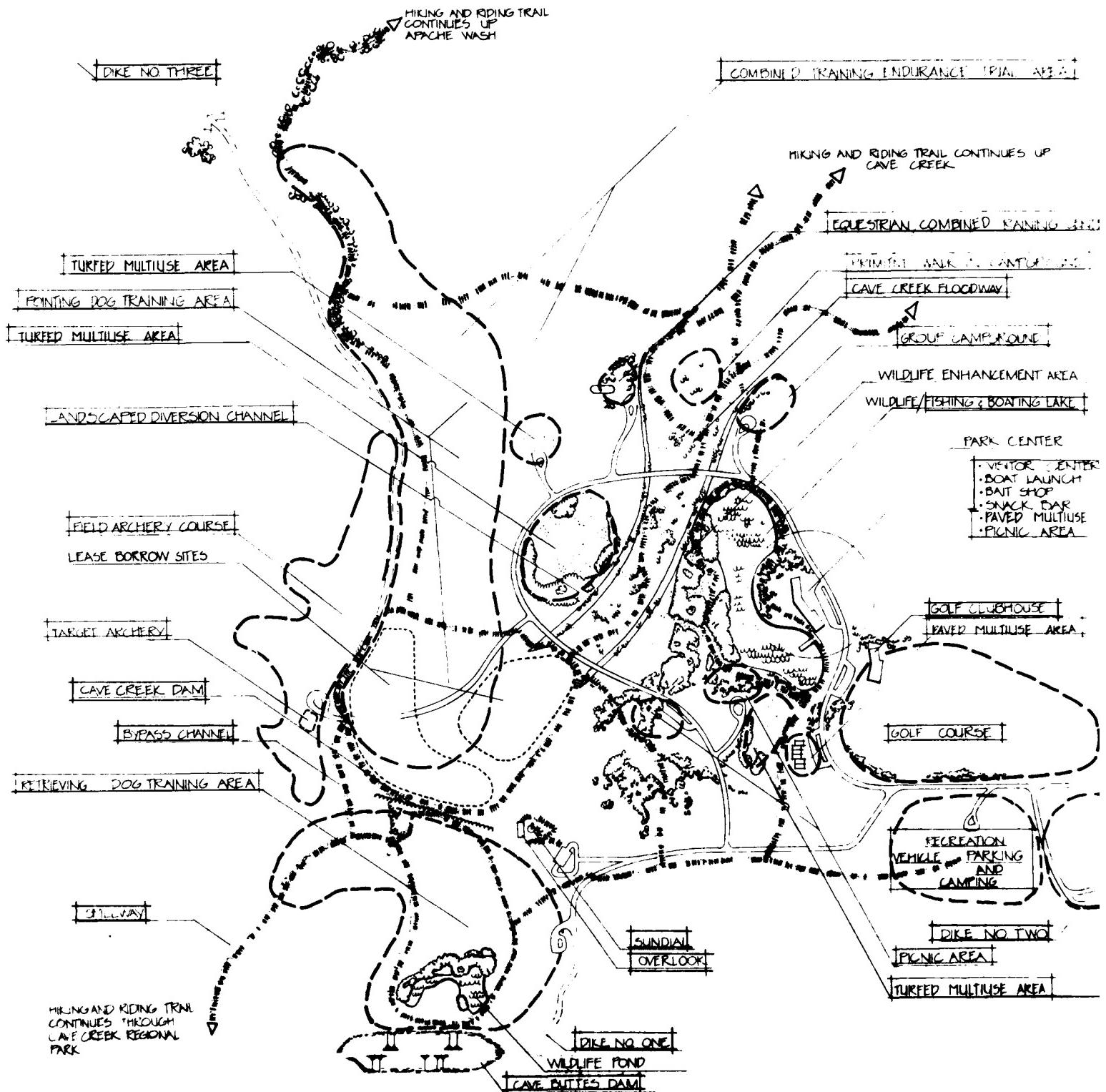


CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

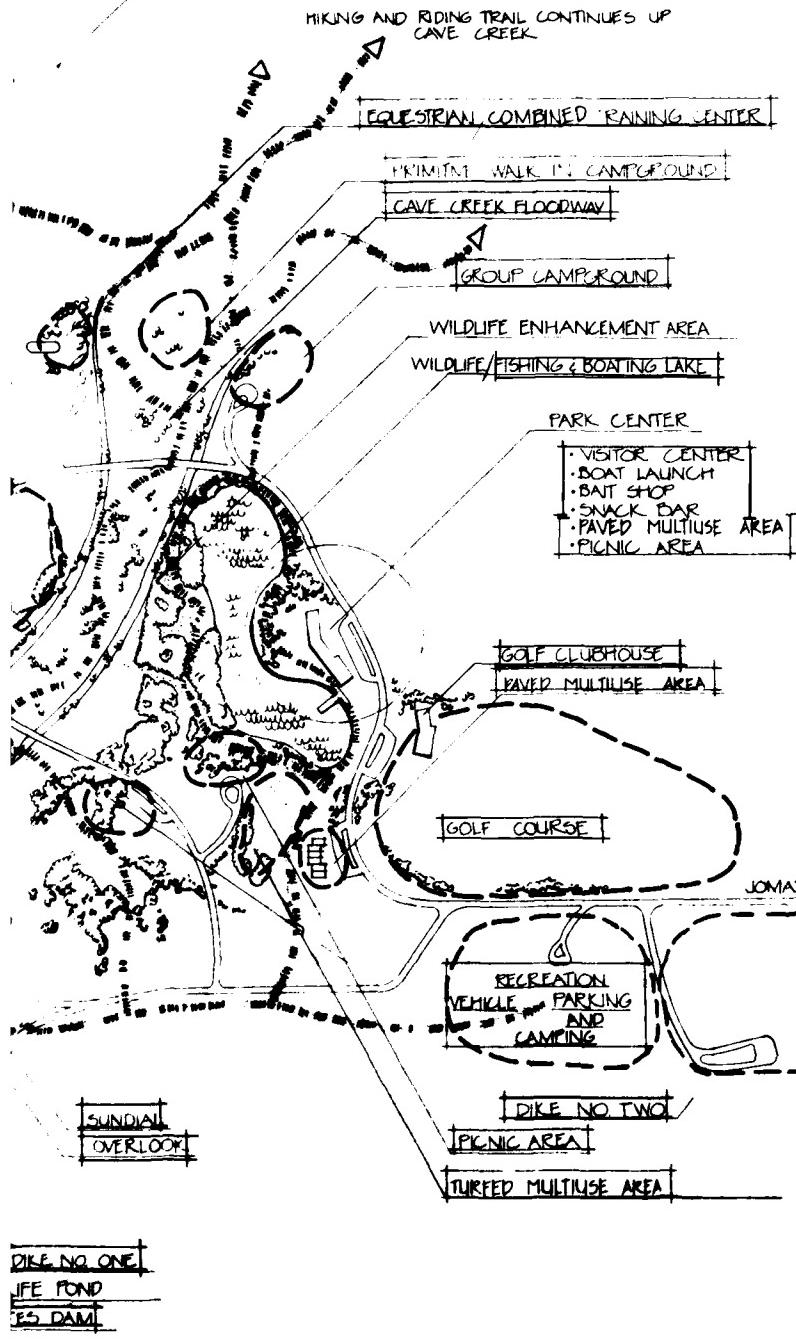
VIEW FROM  
OVERLOOK

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

PLATE 16

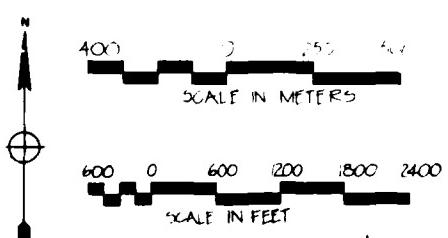


COMBINED TRAINING ENDURANCE TRIAL AREA



**LEGEND**

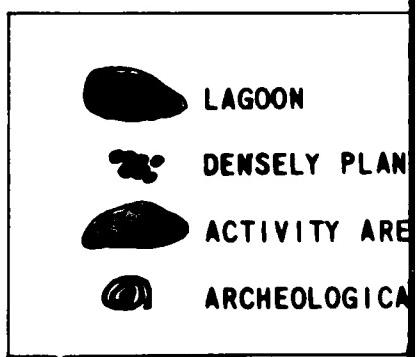
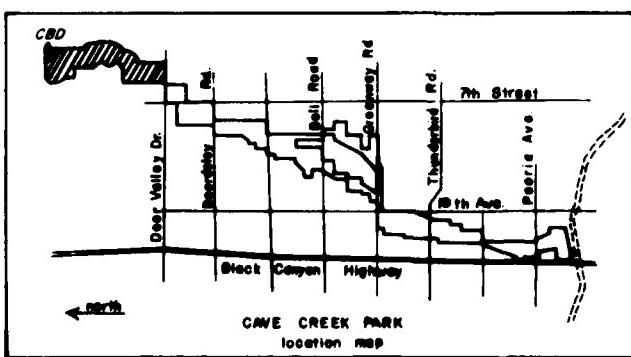
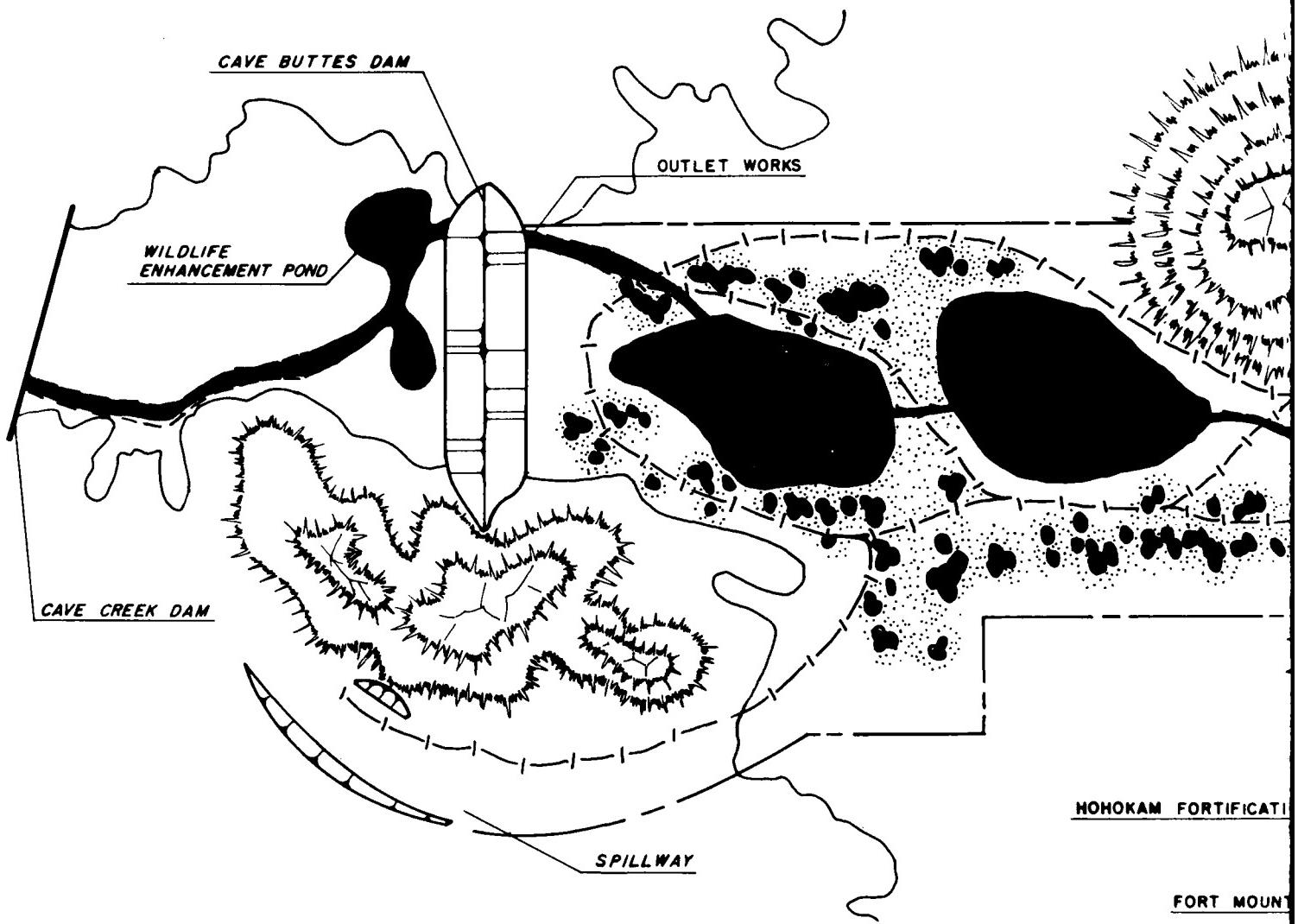
- PAVED AUTOMOBILE ROAD WITH BIKE LANE
- (5) PARKING CIRCLE  
FLOOD CONTROL MAINTENANCE ROAD (DIRT)
- HIKING/RIDING TRAIL
- DENSE VEGETATION
- ACTIVITY AREA
- FUNDING
  - FLOOD CONTROL ITEM
  - COST SHARED RECREATION (50% LOCAL, 50% FEDERAL)
  - NON-COST SHARED RECREATION (100% LOCAL)
  - WILDLIFE ENHANCEMENT (25% LOCAL, 75% FEDERAL)

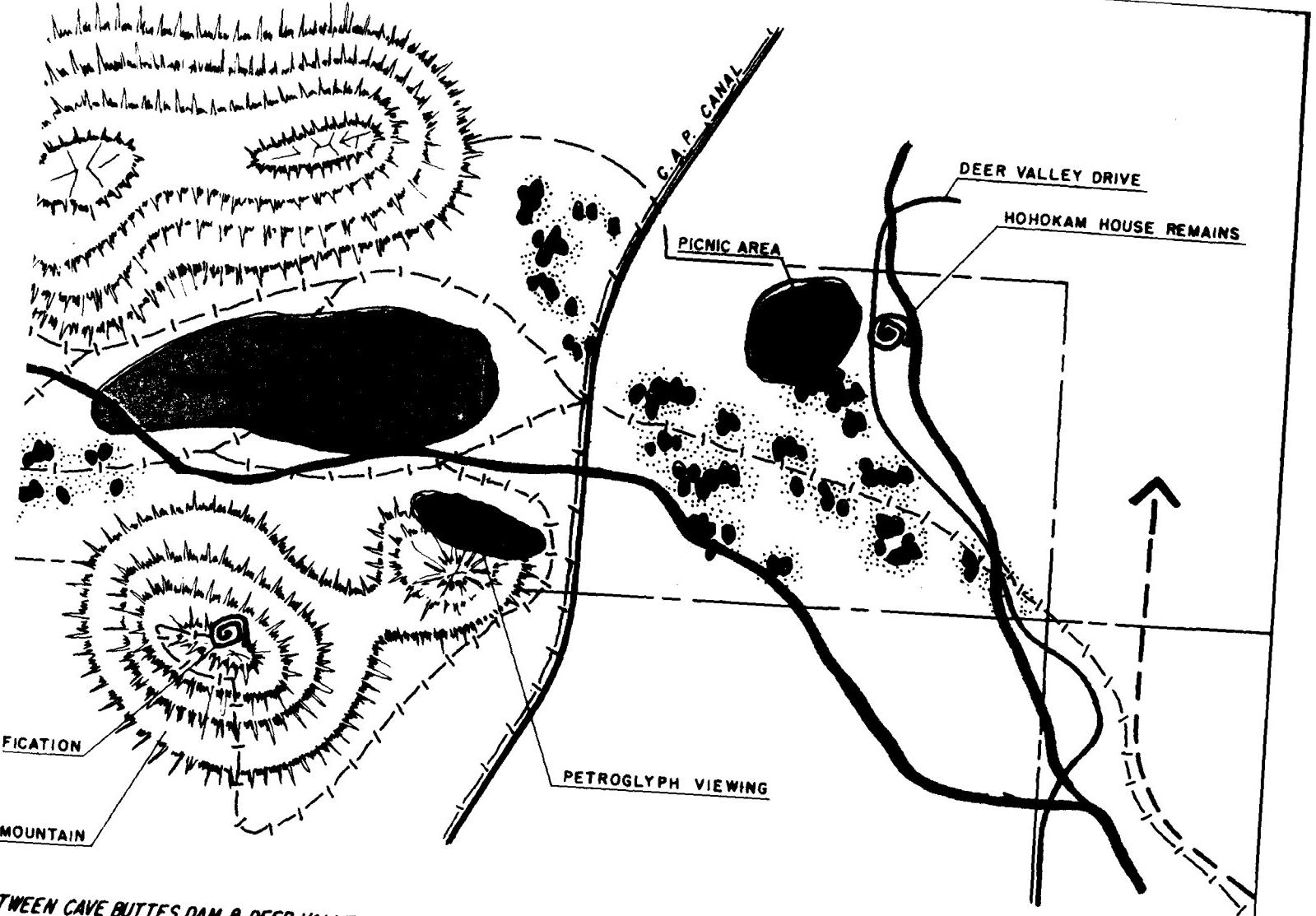


CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

**SITE PLAN  
PHASE 2**

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT





BETWEEN CAVE BUTTES DAM & DEER VALLEY DRIVE ARE 100% LOCAL RESPONSIBILITY.

### LEGEND

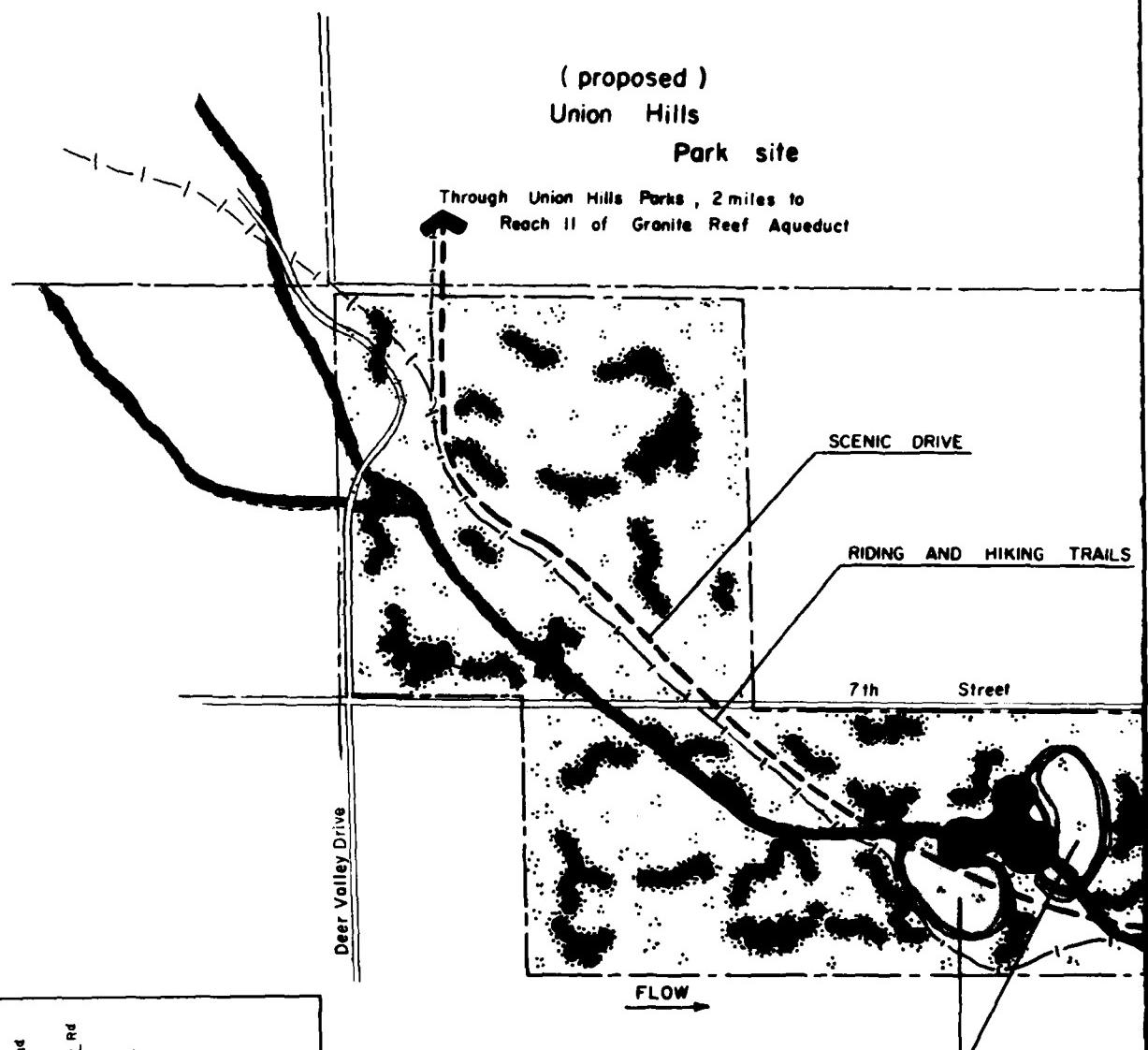
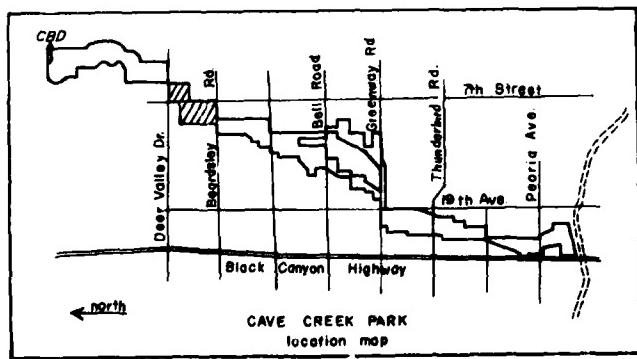
PLANTED VEGETATION  
AREA  
GICAL SITE

- Scenic Drive
- Project Boundary
- Cave Creek
- - - - Riding and Hiking Trail

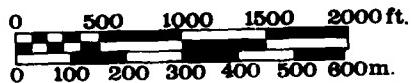
CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

CAVE CREEK  
REGIONAL PARK

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT



ALL RECREATION FEATURES BETWEEN DEER VALLEY DRIVE & BEARDSLEY ROAD  
ARE 100% LOCAL RESPONSIBILITY.

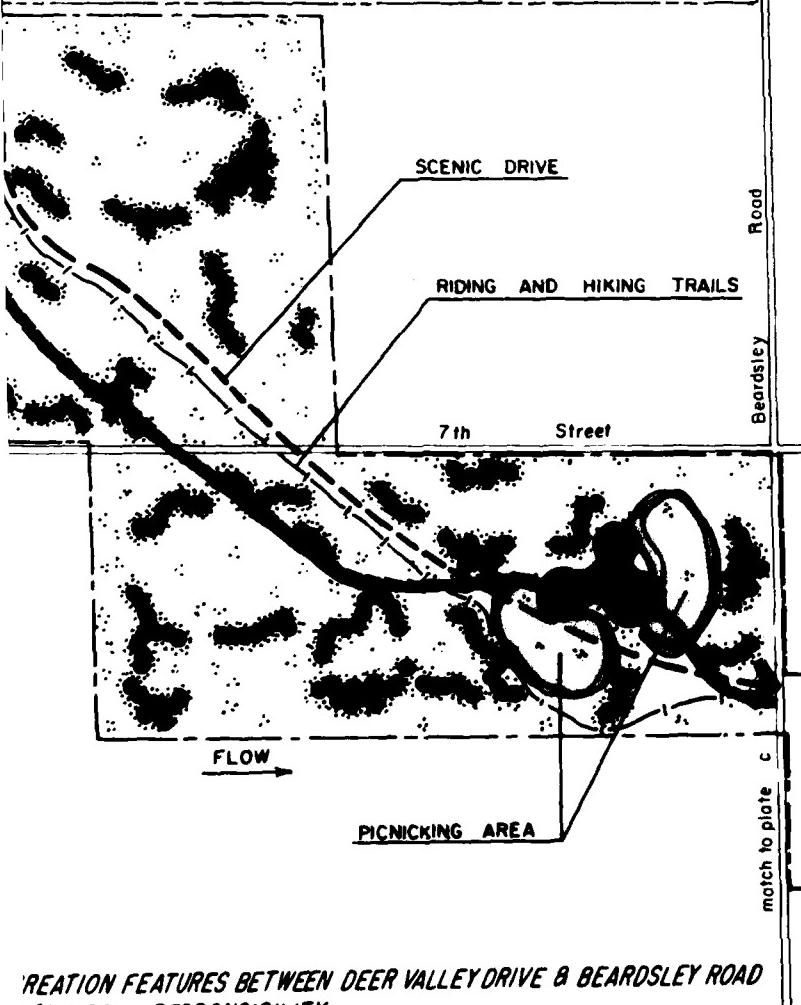


( proposed )

Union Hills

Park site

Through Union Hills Parks , 2 miles to  
Reach II of Granite Reef Aqueduct



#### LEGEND

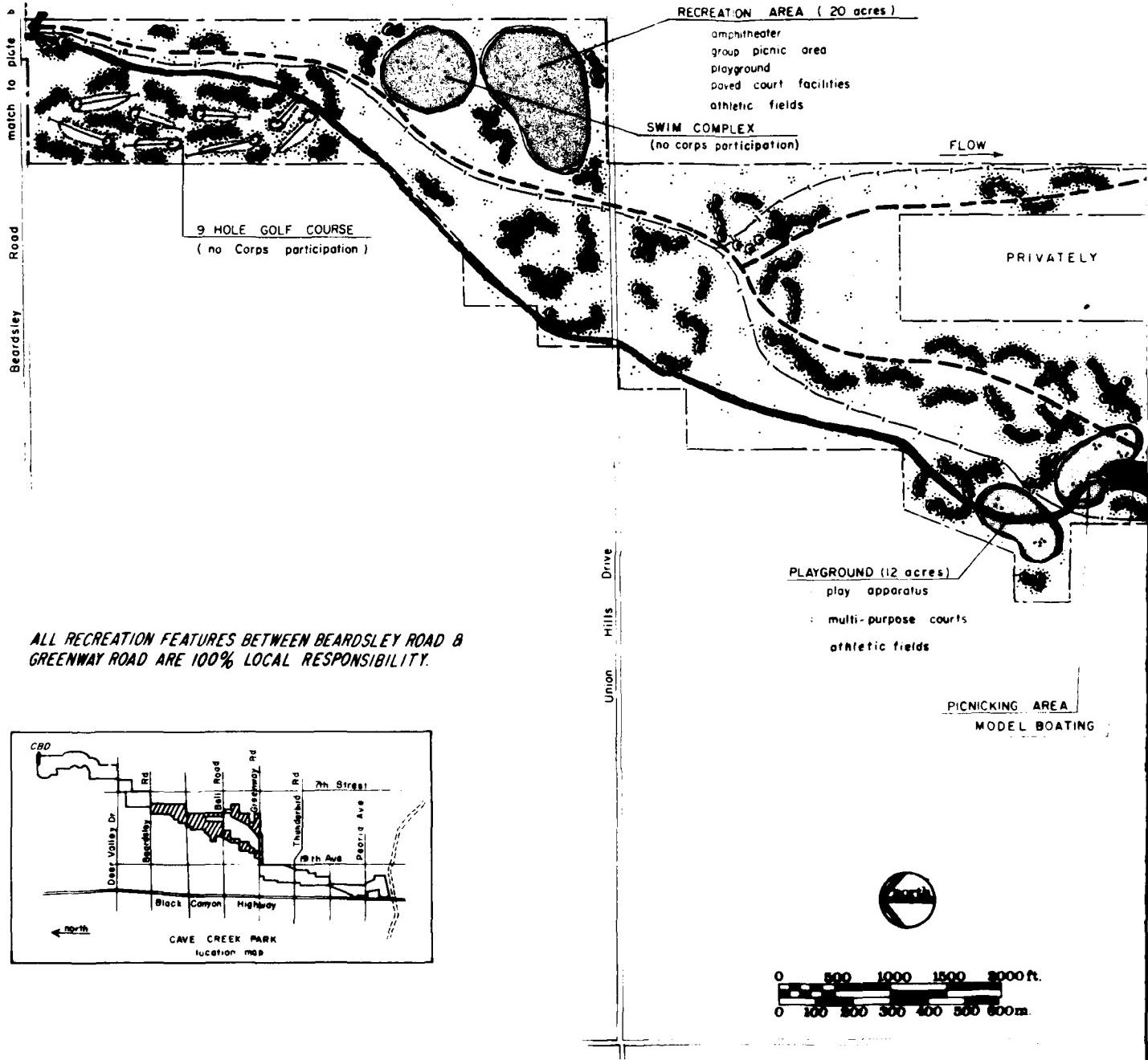
- DENSELY PLANTED VEGETATION
- ACTIVITY AREA
- ARCHEOLOGICAL SITE
- SCENIC DRIVE
- PROJECT BOUNDARY
- CAVE CREEK
- RIDING AND HIKING TRAIL

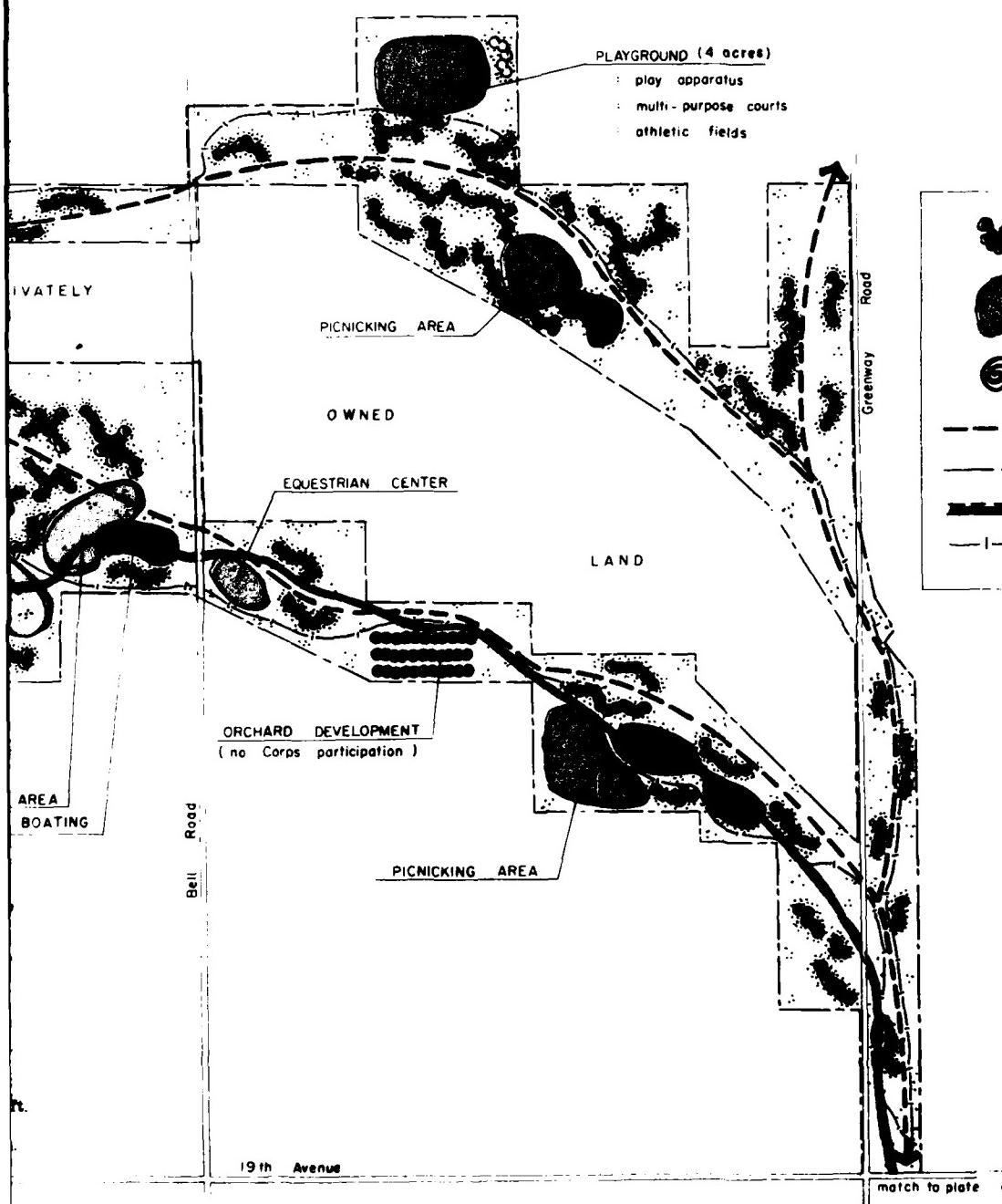
CREATION FEATURES BETWEEN DEER VALLEY DRIVE & BEARDSLEY ROAD  
1% LOCAL RESPONSIBILITY.

CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

CAVE CREEK  
REGIONAL PARK

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

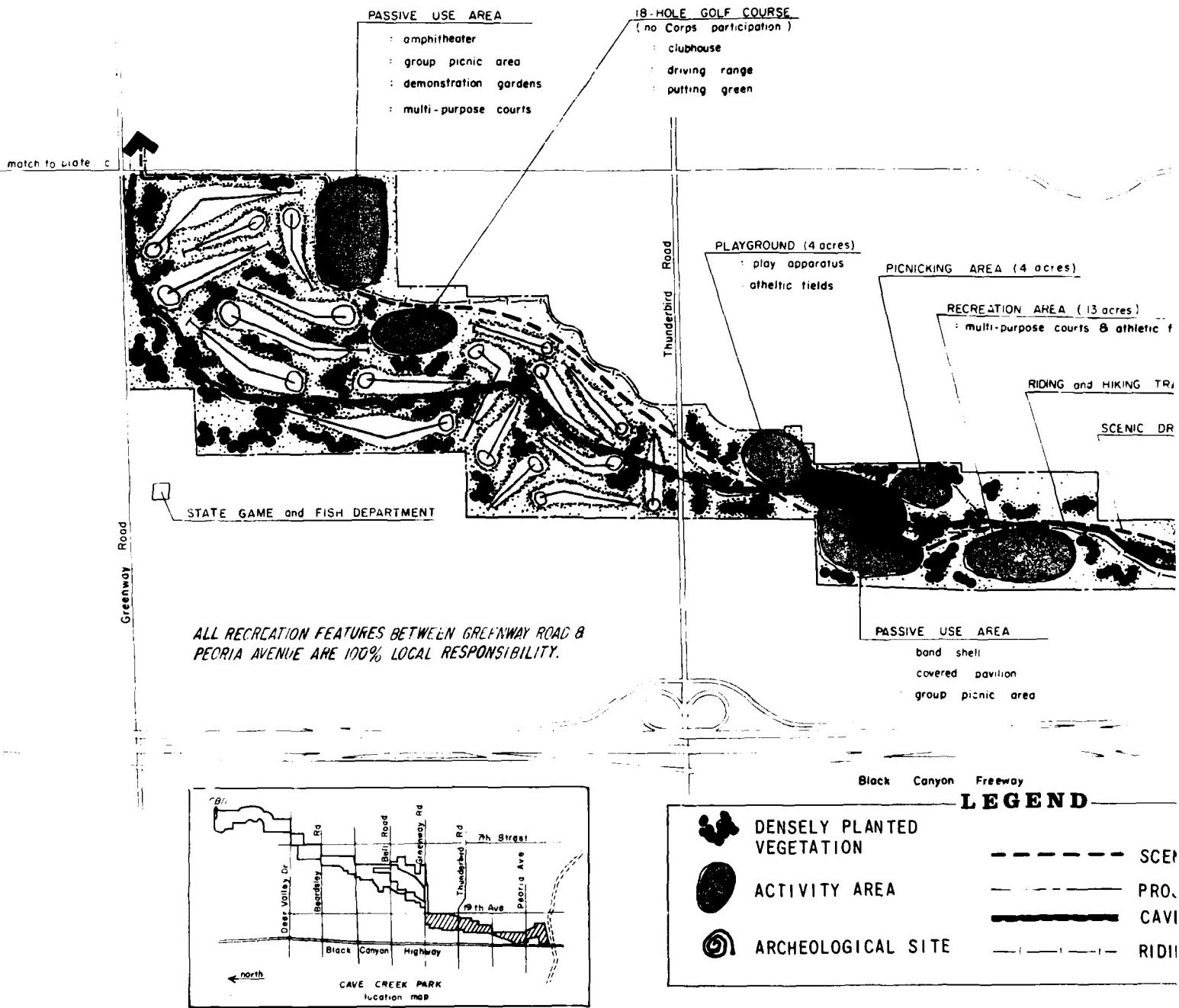




CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

## CAVE CREEK REGIONAL PARK

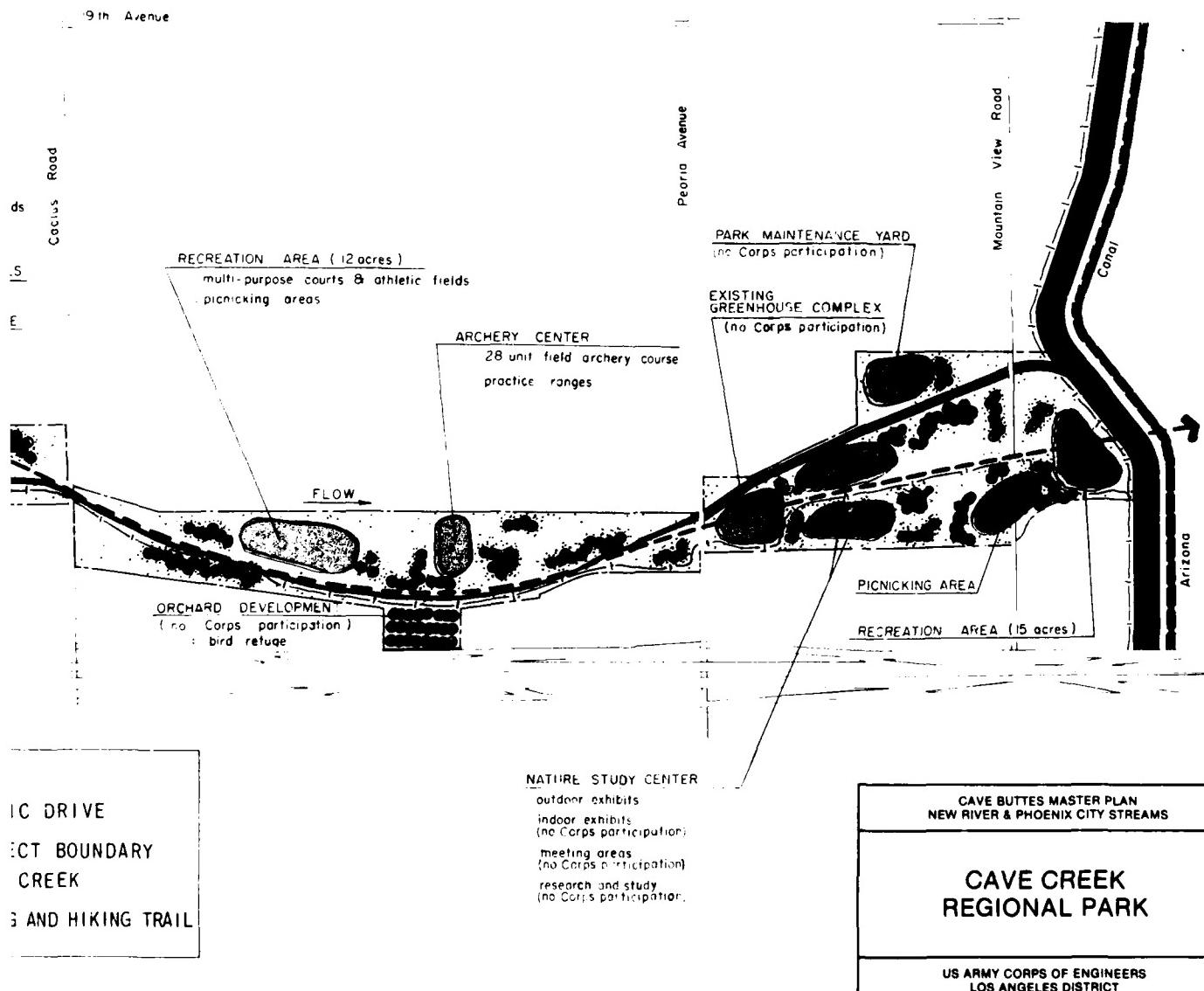
US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

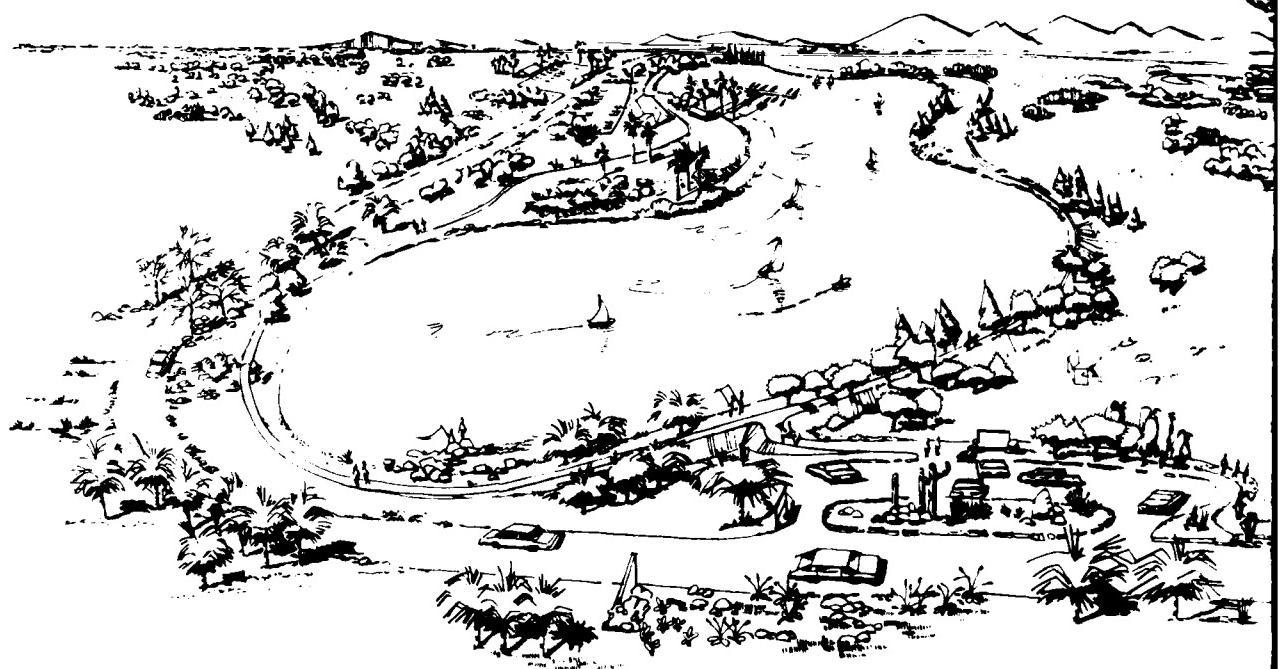




0 500 1000 1500 2000 ft.  
0 100 200 300 400 500 600 m.

SCENIC DRIVE, TRAILS, PICNICKING AREA, RECREATION AREA  
OUTDOOR EXHIBITS & LANDSCAPING BETWEEN PEORIA AVENUE  
& ARIZONA CANAL DIVERSION CHANNEL ARE COST SHAPABLE ITEMS.





**LOOKING SOUTH OVER PROPOSED LA**



**LOOKING SOUTH OVER PROPOSED LAKE**

CAVE BUTTES MASTER PLAN  
NEW RIVER & PHOENIX CITY STREAMS

**PHASE 2  
AERIAL VIEW**

US ARMY CORPS OF ENGINEERS  
LOS ANGELES DISTRICT

END

DATE  
FILMED

10-83

DT